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GEOLOGY AND MINERALOGY.

GEOLOGY AND EVOLUTION.

BY THE LATE PROF. B. F. MUDGE.

CHAPTER III.—MOLLUSKS.

In the examination of the sub-kingdom of Mollusks, we find at the beginning nearly all ranks of groups fully represented. In the address of Vice-President J. W. Dawson, before the American Association, in 1875, he says: "Here then meets us at the outset the fact that in as far as the groups of annulose and molluscous animals are concerned, we can trace these back no farther than in a period in which they appear already very highly advanced, much specialized and represented by many diverse forms." Development or evolution, if a law of nature, should begin with the lowest of each sub-kingdom, and symmetrically advance to the highest. But the first Mollusks of even below the Silurian, are associated with Pteropods, which are (next to the Cephalopods) the highest order; and the latter soon appear. In addition, some of the lowest forms are late in coming forward on the stage of life. Some genera come and retire in a short period of time; others, like the Lingula, are seen early in the Lower Silurian, both in Europe and America, and are in existence in our present seas.

The most noticeable feature of this question of development is, that in nearly all cases where a definite progression is claimed, either in this sub-kingdom or any other, the species are represented by few specimens. Where numerous fossils of one species are found, either no evolution is seen, or the progress

is so slow and slight that it proves so little as to have scarcely any weight in the discussion. Let us notice a few in detail.

Take one of the lowest, *Fusulina Cylindrica*, a small Rhizopod, in appearance like a grain of barley. It has a wide geographical as well as geological range. It is found in Europe, Asia and America, and from the Sub-carboniferous through the Permian, or in one-eighth of the *fossiliferous* age of the globe. It has a series of coils, like the Nautilus, with septa, or partitions, extending part way across the chamber, instead of wholly, as in the Nautilus and Ammonite.* These chambered shells are far higher in rank than this little half chambered shell. Yet during all its long geological life of six million years,† it never extended its partition entirely from coil to coil, to take the first step toward a higher form.

Take another characteristic species of the Carboniferous Age, of a higher order—*Athyris Subtilita*. It is exceedingly abundant in America, as well as in Europe, in all the carboniferous deposits. It also, unlike the *Fusulina*, has a tendency to sport under a variety of forms (hence its name), but always keeps within a prescribed boundary. Thus a quantity of specimens from the same locality, say the lowest, will vary so much, that the extremes being taken, without reference to the intermediate forms, two species would be recognized. Another quantity from a different region, and entirely different horizon, perhaps the highest, will disclose a like variable appearance, but in no greater degree. If the two collections are then placed side by side, one cannot be distinguished from the other. No two will be found alike, but all are *Athyris Subtilita*. Though variability is always a feature of this shell, it constantly retains its specific characteristics, within a narrow circle of vitality, from the lowest Carboniferous through the Permian.

In contrast, as far as versatility is concerned, and of persistence in details, we may take another common carboniferous species, viz., *Productus semi-Reticulatus*. It, like the others, runs through that entire geological age. It derives its name from the reticulation, or crossing lines, of the outer surface of the upper half of the ventral valve of the shell.‡ So little change occurs in its structure, during all its existence, one-eighth of the geological history, that the simple small furrows did not disappear from one half, or extend over the other half, in millions of generations. Is evolution a law of natural history when it is so persistent in small things?

Passing to another order of Mollusks, let us examine the *Ostrea*, or oysters. They date from the Paleozoic§ Age. Like the *Athyris Subtilita*, the whole genus is noted for its sporting variation of outline, and for an equal adherence to its original characteristic phases. Its peculiar foliated texture of shell, too well known to need description, the irregularity in shape and curvature of the valves, and the

*See note on page 21.

‡See Fig. Dana's Manual.

*Paleozoic includes the three divisions, Silurian, Devonian, and Carboniferous.

¿See Fig. Dana's Manual.

simple muscle which binds them together, are the characteristics. They are found now living in nearly all parts of shoal ocean, outside of the Frigid Zones. But a short notice of a simple species will better illustrate the stable nature of this genus. Take *Ostrea Congesta*. It lived through nearly the whole of the Cretaceous Age. It occurs on both sides of the Rocky Mountains over wide areas. It is collected in Kansas over ten thousand square miles, and I have seen fifty thousand on a square acre. While there is in shape as great a variety in any one thousand, as in the living Virginia oyster, still no greater variance can be traced in specimens from the lowest to the highest geological horizon, or from the beds in Texas, New Mexico, or Nebraska. Where so little change occurs, and such constancy of species is seen, what support is there for Lamarck's conjecture that man may have sprung from an oyster? Yet oysters have been known to vary, at least in size, by varying circumstances. A most interesting and remarkable illustration, on a large scale, of the effect of a change of circumstances, in controlling the vitality of Mollusks, has taken place in the north of Europe.

When man in the old stone age first dwelt on the shores of the Baltic Sea, it was a large open bay of the ocean, covering nearly twice as many square miles as at present. It opened into the Arctic ocean on the north, Norway and Sweden being an island. Denmark was then represented by a few low islands, and the salt waters of the ocean had free access. The Baltic was then in reality a part of the ocean, and animals which could live in one, existed in the other. But early in man's history this part of Europe began very slowly to rise, till its pre ent position is about two hundred feet higher than when it began to ascend. This elevation united the islands of Denmark, forming that peninsula, and joined it to the continent. The southern shores of Norway and Sweden encroached on the outlet, and the Baltic became a land-locked sea, smaller and less deep than before. Formerly, as now, it received the drainage of that portion of Europe; and those large rivers, Oder, Vistula, Duna, and others, carried so much fresh water into it, that animals which required water of the full ocean saltness, suffered, and finally disappeared. As the geographical change was very gradual, so also was the change in the Mollusks. The common oyster (*ostrea edulis*), now so abundant in the ocean on the shores of the North Sea, flourished equally well, before this elevation, on what is now the shores of the Baltic. By the quantity of fresh water poured into this inland sea, these oysters became stunted and dwarfed to one-third of their natural size, then diminished in numbers and became locally extinct. The whole history of this interesting change in animal life can be studied in the remains of the "kitchen middens," or "refuse heaps," on the coast of Sweden. There the old pre-historic inhabitants at first ate the full sized oyster, and continued to use it as an article of food till it disappeared, near the close of the elevation, and then were obliged to procure a substitute. This process of local extermination occupied many thousands of years. During all this dwarfing in the oyster, it lost none of its characteristics as a species, and showed no tendency to diverge into any other variety, but simply

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died out. As degradation to a lower character is a part of the theory of evolution, here is just the change of surroundings which should have given us a lower species.

The same modification and local extinction took place in the eatable cockle, mussel and periwinkle (*Cardium edule, Mytilus edulis, and Littorina Littoria*), which are also found in the "refuse heaps." They, as well as many species not eaten by man, and now flourishing in the adjacent North Sea, became stunted and disappeared in the same gradual manner, without any specific change. Others more hardy are now living in both seas, but are much smaller in the Baltic than in the North sea, yet showing no loss of characteristic traits.

If we examine the Ammonites, we shall find a tribe which varies in its characteristics more, probably, than any other mollusk. They appear in the Devonian, and continue to the Eocene Tertiary, or during one-half of the whole geological period. They are represented by more than one thousand species. This great number presents quite a diversity, showing that the family possessed what is called a protean tendency in size and shape. It is claimed by some paleontologists, with some show of facts, that many of these species run into, or are derived from others. It is even contended that genera of the family can be traced from one to another by gradual variation. This is not yet admitted by our leading authorities in paleontology. Notwithstanding the marked variance of different species, they are all distinguished by common characteristics, viz., a chambered shell with sutural or interlacing partitions, and a siphuncle passing, not near the center, but along the side of the chamber, through the partition. The variations of structure are always confined within the circle of these conditions. The thousand species are during this long range of time not only Cephalopods, but restricted to the narrow limits of their family features without crossing its boundaries. There is no proof that they were derived from a lower type or passed to a higher.

Now if we allow the utmost claim of the evolutionists, that all these species and genera sprang from one common stock, even then we may say, the change is too small relatively, to show that any truly low type evolves to a higher. Had they continued to live to the present age, would they, at the same rate of progress, have attained the structure of a low crustacean? The great variety of forms are in most cases no increase in rank, but simply in diversity from those associated in the same seas.

The firm continuance of general features, from the Devonian to the Tertiary, is much stronger against a general system of evolution than the variance of form is in its favor. Is it not more remarkable that during so long a geological term, in all parts of the world, under so great a diversity of circumstances, that there should have been so little change rather than so much.

The Nautilus family presents another somewhat similar history. It appears in the Lower Silurian Age and continues to the present day, through almost the whole of earth's geological history. The Nautilus resembles the Ammonite, but

is distinguished from it by the smooth curved line of its partitions (not interlacing) with the siphon passing through them in the center, or nearly so. These characteristics the Nautilus retains during its geological life. It is claimed that the early species are more embryonic than the later, yet the normal plan is followed so closely in the five hundred species, that the real advance in organic structure is very slight. Most of the species show merely a diverse relation of parts without any relative advance in rank. Notwithstanding the range of earth's conditions has been so extreme that nearly the whole of the Nautili have disappeared, and only three or four species are preserved in our oceans, yet the strange adherence to the normal structure has been such that they have never diverged to the Pteropods or Acephals on the one hand, or developed into a crustacean on the other.

We might multiply facts to show the essential uniformity of Mollusks, but it is enough to state that Murchison, in his "Siluria," gives the following existing genera, viz.: Avicula, Mytilis, Chiton, Natica, Patella, Trochus, Discina, Orbicula, Lingula, Rhynchonella, and Nautilus, as Silurian, which have continued through all geological formations, and are now living in our oceans. The expression of "all-time genus"* Nautilus, which Dana has given to one, may be considered as applicable to all.

The examples frequently quoted, of change of species, without considering that the genera to which they belong is permanently inflexible, is a strong argument against evolution. Thus, Shaler, in the "Geological Report of Kentucky for 1876," has given a very careful and critical memoir on the question of the variation of the more flexible or protean species, with tables of measurements and illustrations by plates, in addition to detailed remarks. One of his examples (*Orthis accidentalis*) shows a variation in the proportion of length to width of forty-five per cent. This would be a strong proof of a tendency to outgrow the normal characters of the shell, did we not know that the genus *Orthis* began at the opening of the Silurian and ended with the close of the Carboniferous, covering three-fourths of our geological time. This shows that while a species may be quite variable within its circle of vitality, that variability may be clearly restricted in generic features.

A similar instance is seen in the fresh water *Planorbis*. Hilgendorf has described a case, where he collected ten graduated varieties of *Planorbis multiformis*, from the beds of a deposit in Switzerland. Yet the genus *Planorbis* has lived from the Jurassic to the present time. The multiform variations of this species, like *Orthis occidentalis* and many others, did not extend to the generic features.

These cases of a tendency to vary in structure (protean species) are frequently quoted in proof of evolution. Although a species is variable, but the genus to which it belongs is unchanged during long geological eras, the real evidence must be considered as bearing against evolution.

*Manual, p. 598.

THE ORIGIN AND CLASSIFICATION OF ORE DEPOSITS.*

BY PROF. J. S. NEWBERRY.

(*Concluded.*)

Mineral Veins. Some writers on economic geology—Werner, Von Cotta and Von Groddeck, for example—enumerate many different kinds of mineral veins; but disregarding the local characters which all ore-deposits exhibit and the hybrids which are formed by the blending of two distinct forms, not of uncommon occurrence, I agree with Whitney in recognizing but three distinct classes, namely:

1. *Gash-veins.*
2. *Segregated veins.*
3. *Fissure-veins.*

Gash-veins may be defined to be those which occur only in limestone, are confined to a single stratum formation, and hence are limited in extent, both laterally and vertically. Typical examples of gash-veins are furnished by our lead deposits of the Mississippi valley. These occur at three horizons, namely, about Galena, in the Galena limestone, belonging to the Trenton group; in Southeastern Missouri, where the Mine La Motte is located, in the equivalent of the Calciferous sand-rock; and in Southwestern Missouri, where the mines of lead and zinc occur in the Lower Carboniferous limestone. The origin of deposits of this character is apparently quite simple. The cavities which form the repositories of the ore are generally the cleavage-planes or joints of a soluble limestone rock that become channels through which surface-water charged with carbonic acid flows in a system of subterranean drainage. We usually find two sets of joints approximately at right angles to each other, and vertical if the rocks are horizontal. To form gash-veins, one or both of these sets of vertical joints are locally enlarged into lenticular cavities or "gashes," whence the name; but sometimes caves of considerable size, irregular pockets, and vertical or horizontal galleries are formed. These are subsequently lined or filled with ore, sulphides of lead, zinc, and iron, originally disseminated through the limestone, and leached out of it by water, which saturates and traverses all rocks in a humid climate. The solution thus formed reaching a cavity has, by evaporation, deposited the ore as a lining to that cavity; narrow fissures being perhaps filled, walls of larger cavities coated with stalactites depending from the roof, etc. Subsequent solution has sometimes widened a fissure once filled with ore, leaving the ore-body as a central partition, a curtain more or less complete hanging from the roof, or a mass of fragments mingled with infiltrated sand and clay in the floor of the cave. In Southwestern Missouri, the Carboniferous limestone contains layers of chert, which are insoluble, and which sometimes form horizontal floors or ceilings of caverns. These,

*From the School of Mines Quarterly, March, 1880.

breaking down by their own weight, have formed masses of *debris*, cemented together by the ore, which has thus acquired its peculiar brecciated character.

From the description of gash-veins given above, it will be seen that they have much in common with the pockets and chambers previously described; but there is this important difference, that the ore filling the gashes and irregular chambers of the lead-bearing limestones is indigenous, having been derived from the leaching of the adjacent rock, while in the chamber-mines of the West the ore is exotic, having been brought up through fissures from a remote source below; so that, while in physical characters the western gold and silver-bearing ore-chambers resemble gash-veins, they are really but appendages to true fissure-veins, and only occur in a country that has been much broken by subterranean forces.

Segregated veins are confined to metamorphic rocks, are conformable with their bedding, and are limited in extent both laterally and vertically. Their ore-bodies form lenticular masses of greater or less dimensions, of which the material is chiefly quartz, which has segregated (that is, separated) from the surrounding rock. The quartz-veins so abundant in the gneisses and schists of Canada, New England and the Alleghany belt are all examples of this class of ore-deposits. The most important constituent of segregated veins is gold, which here seems to have been mechanically dispersed throughout sedimentary rocks, and to have been concentrated with the quartz in the process of metamorphism to which they have been subjected. With the gold we always find iron pyrites, sometimes chalco-pyrite, and the latter occasionally in sufficient quantity to be worth working. From these remarks it may be inferred that segregated veins have no deep-seated origin, are less continuous in depth and laterally than fissure-veins, and therefore constitute a less permanent foundation for mining enterprises. It may be said, however, that some of them are of enormous dimensions, and that they not unfrequently occur in succession, or so approximate that they are equivalent to a continuous mineral deposit.

Fissure-veins occupy crevices which have been formed by subterranean forces and have been filled from a foreign source. They traverse indiscriminately all kinds of rock, and are without definite limits laterally or vertically. They have as characteristic features smooth, striated, sometimes polished, walls (slickensides) clay gouges or selvages on one or both sides, and a banded or ribboned structure throughout. The veinstone is usually quartz, and the constituents include the ores of all the metals. The mode of formation of fissure-veins is apparently this: In the regions where the earth's crust is broken up in the adjustment of the cold and hard exterior to the cooling and shrinking nucleus, cracks are formed, often miles in extent, along which the rocks suffer displacement, sliding on each other to form what are known as "faults." As the planes of these faults are more or less undulated, with displacement the bearing is upon the projecting bosses of each side. Between these, open fissures are left of greater or less dimensions. These reach down to a heated zone, and form the conduits through which thermal waters flow to the surface. Such waters coming in different localities

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from different depths, and leaching rocks of various composition under great pressure and high temperature, having great solvent power, become loaded with various mineral matters. As they rise to the surface, the pressure and temperature are reduced, and the materials held in solution are deposited to line and perhaps ultimately fill the channels through which they flow. This theory of the filling of mineral veins—that is, by precipitation from heated chemical solutions coming from below—is supported by such an array of facts that it must be accepted by all who will make a careful and unprejudiced study of the subject. It is true, however, that various other theories have been, at one time or another, put forth for the explanation of the phenomena. Among these, a few deserve a passing notice. They are:

1. *The theory of igneous ejection*, according to which the matter filling mineral veins has been erupted like that of trap dikes, and such veins as those of Lake Superior containing metallic copper have been suggested as affording good examples. But here we find metallic copper and silver associated, and each chemically pure; whereas if they had ever been fused, they certainly would have formed an alloy. The copper is also found in crystals of calc-spar and other minerals, where it must have been deposited with the other constituents of the crystal, and that crystal formed from solution. Other opposing facts might be cited; butit will be sufficient to say that not one sound argument can be advanced in favor of this theory.

2. *Aqueous deposition from above.* This theory, first advanced by Werner, but since generally abandoned, supposes the contents of mineral veins to have been deposited from a solution which flowed into the fissures from above; but in that case the vein-matter should be horizontally stratified, limited in extent downward, and spread over the surface adjacent to the fissure; whereas no one has yet reached the limits in depth of the ore in a true fissure-vein, and the characteristic banded structure can only have resulted from succe-sive depositions of a long-continued flow of a hot solution. This theory has been recently advocated in this city, by Prof. Stewart of Nevada; but it is not only not sustained, but is really disproved by all the facts observed by the writer in some years devoted to the study of our western ore-deposits.

3. *Lateral secretion.* According to this theory, the material filling all mineral veins has leached into the cavity from the wall-rocks. While this is true of gash-veins, it can have played but a very subordinate part in the deposition of ore in fissure-veins. This is proved by the facts that different sets of fissures which cut the same formation frequently contain very different ores; and where the rocks of totally different character are, by faulting, brought to form opposite walls of a fissure, the ore may be symmetrically deposited in corresponding layers. It may also be said that the same fissure frequently traverses several formations, and yet its character may be essentially the same throughout.

4. *Sublimation.* The facility with which certain metals are volatilized, and the fact that various minerals have been deposited from vapor, have formed the

basis of this theory; yet it is difficult to see how any one can ascribe more than a local and insignificant effect to this cause. It is true that the action of water, as steam, is much the same as when fluid and highly heated, in the solution and transport of minerals; and the deposit of mercury; sulphide of iron, and even gold, from the mingled water and steam of the California geysers proves this. So we may concede that steam has been an agent in the chemical solution and precipitation of ores; but this is a very different thing from the sublimation of the metals represented by these ores, and all knowledge and analogy indicate that the silica which forms so large a part of vein-stones, and is so often seen in combs of interlocking crystals, has been deposited from an aqueous solution. But argument is really wasted in a discussion of the filling of fissure-veins, since we have examples that seem to settle the question in favor of chemical precipitation from ascending hot water and steam. In the Steamboat Springs of Western Nevada, for example, we in fact catch mineral veins in the process of formation. These springs issue from extensive fissures which have been or are filling with silicious vein-stone that carries, according to M. Laur, oxide of iron, oxide of manganese, sulphide of iron, sulphide of copper, and metallic gold, and exhibits the banded structure so frequently observed in mineral veins.*

In regard to the precise chemical reactions which take place in the deposition of ores in veins, there is much yet to be learned, and this constitutes an interesting subject for original investigation, which I earnestly commend to those who are so situated that they can pursue it.

It may be noticed, however, that the thermal springs which are now forming deposits like those in fissure-veins, contain alkaline carbonates and sulphides, and we have every reason to believe that highly carbonate alkaline waters containing sulphureted hydrogen under varying conditions of temperature and pressure are capable of taking into solution and depositing all the metals and minerals with which we meet in mineral veins.

To these necessarily brief notes on the filling of mineral veins should be added some interesting examples of the mechanical filling of fissures which have been recently brought to light in western mining. These are furnished by the remarkable deposits of gold and silver ore in the Bassick and Bull Domingo, near Rosita, Colorado, and the carbonate mine at Frisco, Utah. All these are apparently true fissure-veins, filled to as great a depth as they have yet been penetrated, by well-rounded pebbles and boulders which have fallen or been washed in from above. The porous mass thus formed has been subsequently saturated with a hot ascending mineral solution, which has cemented the pebbles and boulders together into a conglomerate ore. In the Bassick, this ore consists of rich telluride of silver and gold, free gold, and the argentiferous sulphides of lead, zinc, copper and iron. In the Bull-Domingo and Carbonate mines, the cementing matter is argentiferous galena. That the pebbles and boulders have come from above is distinctly shown by the variety in their composition and the organic matters associated with them. In the Bull-Domingo and the Bassick, the pebbles consist

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of various kinds of igneous rock, mingled with which in the latter are masses of silicified wood and charcoal; while in the Carbonate mine, the pebbles are mainly trachyte; but with these are others of limestone and quartzite.

Fossils and other foreign bodies have before this been found in mineral veins, and Von Cotta mentions the occurrence of quartz pebbles extending to the depth of 155 fathoms in the Grüner Lode at Schemnitz, Saxony; but no conglomerate veins like those mentioned above are known to exist elsewhere, and they constitute another of the many new forms of ore deposit which the exploration of the rich and varied mineral resources of the United States has brought to light. To enumerate and classify these, has been the chief object of this article.

In regard to the ultimate source of the metallic matters which give value to our ore deposits, but little can be said with certainty. The oldest rocks of which we have any knowledge, the Laurentian, contain gold and copper, which are indigenous, hence as old as the rocks that contain them, and have been simply concentrated and made conspicuous in the process of their metamorphism. These rocks are all sediments and the ruins of pre-existing continents. By their erosion, they have in turn furnished gold, copper, iron, etc., to later sediments by mechanical dispersion and chemical solution. We now find gold everywhere in the Drift from the Canadian Highlands, and we have every reason to believe that all the sedimentary strata more recent than the Laurentian have acquired a slight impregnation of several metals from them in addition to what they have obtained from other sources, and we may conclude that the distribution of many of the metals is almost universal. Sea-water has been proved to contain gold, silver, copper, lead, zinc, cobalt, nickel, iron, manganese and arsenic; and there is little doubt that all the other metals would be found there if the search were sufficiently thorough. Hence, sedimentary rocks of every age must have received from the ocean in which they were deposited some portion of all the metals, and for the formation of metalliferous deposits some method of concentrating these would alone be required. A pretty theory to explain such concentration through the agency of marine plants and animals has been suggested by some German mineralogists, and amplified by Professors Pumpelly and T. S. Hunt. Plants have been credited with the most active agency in this concentration; but evidence is still wanting that either plants or animals have played any important part in the formation of our mineral deposits. The remains of sea-weeds are found in the greatest abundance in a number of our Palæozoic rocks, and it is almost certain that the carbonaceous ingredient in our great beds of bituminous shale has been derived from this source; yet we find there no unusual concentration of metallic matter, and none of the precious metals has ever been detected in them.

The metallic solutions which have formed our ore-deposits have been ascribed to two sources. One theory supposes that they have drained highly metalliferous zones deep in the interior of the earth; the other, that they have leached diffused metals from rocks of different kinds comparatively near the surface. The latter view is the one that commends itself to the judgment of the writer. However

probable such a thing might seem, no evidence of the existence of distinct metallic or metalliferous zones in the interior of the earth has been gathered. On the contrary, volcanic emissions, which may be supposed to draw from a lower level than water could reach, are not specially rich in metallic matters, and the thermal waters which have by their deposit filled our mineral veins must have derived their metallic salts from a zone not many thousand feet from the surface. The mineral springs, which are now doing a similar work, are but part of a round of circulation of surface-water, which, falling from the clouds, penetrates the earth to a point where the temperature is such as to drive it back in steam. This, with fluid water under pressure and highly heated, possessing great solvent power, may be forced through vast beds of rock, and these be effectually leached by the process. Should such rocks contain the minutest imaginary quantity of the metals, these must inevitably be taken into solution, and thus flow toward or to the surface, to be deposited when, by diminished temperature and pressure, the solvent power of the menstruum is diminished. It is evident from these facts that we can not trace the history of the metals back beyond the Laurentian age. And since we find them diffused in greater or less quantity through the sedimentary rocks of all ages, and also find processes in action which are removing and re depositing them in the form of the ore deposits we mine, it is not necessary to look farther than this for a sufficient theory of their formation.

GEOLOGICAL NOTES ON THE REGION OF SILVER CLIFF, COL.

BY SAMUEL J. WALLACE.

The rough country for twenty miles east of Silver Cliff has been dry land through nearly all the known geologic ages. It is the southern part of an old land which reaches north through the state, and against which the great ocean beat to east, west, and south. This may be termed the Madre land, from the Sierra Madre mountain system, along which it lies, and as being the mother-land of this region.

It was a mountain region, of stratified metamorphic granites, or granitoid rocks. These are traversed by numerous barren leads, and some which bear valuable minerals, iron, lead, gold and silver.

The great Sangre de Cristo range, ten miles westward, is capped by a thousand feet of conglomerate of granitoid boulders, which were washed down from these older mountains, when that was the bed of the sea, since upheaved into the great range of the continent. The core and west side of that range, here, are eruptive granites, and also bear leads with gold, silver, copper and iron. The range bears other sedimentary strata, including limestones, on its flanks north and south, on each side, probably of the same age as those extending south far into New Mexico, and north beyond Leadville, and attributed variously to the Silurian, Devonian, or Subcarboniferous ages. These probably originally covered the whole range. Fossils have been brought from Hayden's Pass, north, but I do not know of what age they were.

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About Silver Cliff and Rosita are extensive Trachyte, or light colored lava rocks, bearing mineral. These extend for ten miles nearly east and west; and evidently consist of various outpours differing in their appearance and minerals. Their geology and relations are an interesting field of study.

Perhaps the latest is that on which Silver Cliff is built, which bears a peculiar manganese ore carrying free milling chloride of silver, of the Racine Boy type: this appears over an area of two miles east to west, and a mile and-a-half north to south. It has a black and glossy pitchstone core exposed at various places under it.

North-west of this is another body, rather larger, and to the south-east about Rosita another still larger, which are probably older, different in appearance and with different minerals, iron, lead, zinc, copper, sulphurets, and manganese, with silver diffused through the rocks, and in more or less defined leads. All these carry silver in small quantities, making a wonderful field for future mining, from the immense quantity of the rock and its accessibility. After the melted trachyte was outpoured and by cooling left fissures and deep cavities, no doubt water penetrating the deep recesses of the earth was heated and caused to take up minerals in solution and bring them to the surface, where on cooling they were deposited in various forms in the passages and through the broken and porous trachyte.

The Bassick and Bull-Domingo mines are of this type distinctly, while no doubt lesser and more diffused outruns have produced the minerals throughout the trachyte beds. This trachyte is very old, as shown by hundreds of feet of denudation and ravines cut in it, especially toward Rosita. There is a sedimentary formation, which I have named the Eositon, five miles north-east of Silver Cliff, formed from washings of these old trachyte beds and the granite east. This extends for miles in a line from Dora to Bassick's, in the bed of an old stream, half mile wide. Modern streams have cut down showing nearly a hundred feet in thickness. The strata are mostly soft, some fine grained and some coarse with gravel; often of soft talc-like nature. At one place, west of Cañon road it is capped with a local deposit of limestone, containing granite boulders, valuable for lime.

Half mile west of Apperson's mill the upper strata contain quantities of fossil wood, of many familiar kinds, apparently showing the grain finely. No animal remains have yet been found in it, but it may contain wonders of the time when the monsters roamed this land, whose bones were found by Profs. Marsh, Cope and Mudge, twenty-five miles north, at Prospect Park. There is a stratified sand formation overlying the trachyte north and west, which shows the presence of a body of water at a late age nearly as high as the city, at least. Animal remains, with huge teeth, have been found in this, in the shaft of the St. John claim two-and-a-half miles north-west. There is a deposit of coarse and fine worn gravel for twenty-five miles south and ten miles wide sloping into Grape creek valley, which may be known as the Wet Mountain Gravels.

There are indications of Glacial action extensively in this region, and no doubt these gravels owe much to it. Debris of the Racine Boy type of ores is scattered over the hills for miles north-east.

FOSSIL REMAINS IN SOUTHWEST MISSOURI.

J. L. LEWIS, BOLIVAR, MO.

Southwest Missouri is rich in minerals, abounds in wonderful caves and springs, and her fossils are worthy of scientific notice. The Missouri School of Mines at Rolla is arousing a new interest in our scientific circles, and is doing much to develop our natural resources.

A few years ago Mr. G. C. Broadhead read a paper before the St. Louis Academy of Science, in which he refers to the late discovery of the remains of a horse at Papinville, Bates county, Mo. Mr. O. P. Ohlinger, in digging a well, cut through a bed of thirty feet and ten inches of yellowish clay. Here he found a four-inch stratum of bluish clay and gravel, beneath which was a bed of sand in which the tooth was found. Under this sand bed was a gravel bed five feet deep filled with rounded pebbles, generally hornstone, many of which adhered firmly together. Some of the pebbles taken from this bed were of iron ore, coal and micaceous sandstone. Some remains of fluviatile shells were also found in this gravel bed nearly thirty-two feet below the surface. I have thus described this bed for the observation of others in this district.

The tooth was sent to Prof. Joseph Leidy, of Philadelphia, who, after a most critical examination pronounced it to be the last upper molar of a horse, and he thought of some extinct species. From a similar gravel bed on the bank of the river Marais des Cygnes the fragment of a tusk was found closely resembling that of a mammoth. The full length of this tusk was about seven feet and four inches.

Ten miles from Papinville on the bank of the river Marais des Cygnes there appears to be the same formation as the one above described. Mr. Broadhead considers them to be altered drift, but older than the bluff or Loess. As these gravel beds are abundant on the Osage river and its tributaries, it would be well for those living in this vicinity to be on the lookout for fossil remains, and carefully preserve all such for scientific investigation.

A FOSSIL FOREST.

An interesting discovery has been made at Edgelane Quarry, Oldham, England. The quarrymen, in the course of their excavations, have come upon what has been described as a fossil forest. The trees number about twelve, and some of them are two feet in diameter. They are in good preservation. The roots can be seen interlacing the rock, and the fronds of the ferns are to be found imprinted on every piece of stone. The trees belong to the middle coal measure period, although it has been regarded as somewhat remarkable that no coal has been discovered near them. The coal is found 250 yards beneath.

METEOROLOGY.

TORNADOES.

ISAAC P. NOYES, WASHINGTON, D. C.

By the study of details we learn principles, and only by a proper study of details can we comprehend principles. Principles, however, once grasped and understood, minute details, though still of as much importance in themselves, become a secondary matter to him who has mastered the principles that form the sum total of those details. We have the alphabet, then words, clauses, sentences, etc. The child learns the alphabet, then to form words, and finally advances to sentences and from sentences to composition in general. He who has made himself master of composition, although he heeds the correct juxtaposition of the minor details of letters and words, in one sense ignores them, or better perhaps, let them take care of themselves.

When we advance to science he who thoroughly understands the principles of his department can the better comprehend and explain all its little variations and is not all the while at a loss to explain trifling details or troubled with them as one who has not yet mastered these details.

How difficult it is to understand the situation of objects when viewed from a wrong point, and how easy to comprehend them when the right point of view is obtained. How difficult to understand the interpretations of nature through some wrong theory or false hypothesis, but how plain they become when viewed with the full knowledge of the natural laws that govern them. As for example, how difficult centuries ago to understand and to be able satisfactorily to explain the physical condition of the planets of the universe before the Copernican theory became an established fact, or to explain the properties and full purpose of the blood before the circulation of the blood was established as a fact; surely it has always been a fact, but like many other scientific facts it was for ages unknown to man. Only within the past few years, as has heretofore been stated, have we had sufficient data in the department of the weather whereby we may satisfactorily explain its ever varied changes. The daily weather map has become the instrument whereby we may understand these changes and readily comprehend the principles that govern all our weather, from the warm, quiet, sunny days that predominate in mid-summer to the cold tempestuous weather of winter and spring.

Before we had these data we were greatly in the dark on this subject as a whole. Certainly we understood certain minor details, but we were at the foot of the mountain. Through the weather map we ascend to the very highest peak and with a bird's eye view survey the whole broad landscape. We are lifted above

the earth and its commotions of whirlwind and storm, and quietly survey the scene and note its peculiarities with the combined indifference and intense interest of a commanding general surveying a battle or a surgeon performing some difficult operation. Let the elements be ever so quiet or rave so terribly, the weather map lifts us above them and we quietly note the effect and trace up the cause. And the cause of the terrible commotions that so frequently visit us are as readily traced and explained as the most balmy days of "Indian Summer."

One cause produces all the effects and all the effects proceed from one and the same cause, notwithstanding their variety, and whether wet or dry, and the various names given to them. In the past, prior to 1870, it is not surprising that from the minor and disconnected details we should have had queer notions of the weather, and that such names as typhoon, tornado, cyclone, hurricane and simoon should have been coined to represent the wind commotions of the elements in different parts of the earth, and that people should think that there must be as much difference in the things known by these various names as in the spelling and sound of the names themselves.

According to Webster, and others will not essentially differ from this authority, a

TYPHOON is "a violent whirlwind that rushes upward from the earth, whirling clouds of dust; probably so called because it was held to be the work of Typhon or Typhos, a giant struck with lightning by Jupiter and buried under Mt. Ætna."

1. A violent tornado or hurricane occurring in the Chinese seas.

2. Sometimes the simoon.

TORNADO—"A violent gust of wind, or a tempest distinguished by a whirling, progressive motion, usually accompanied with thunder, lightning and torrents of rain, and commonly of short duration and small breadth; a hurricane."

CYCLONE—"A rotatory storm or whirlwind of extended circuit."

HURRICANE—"A violent storm characterized by the extreme fury of the wind and its sudden changes; in the East and West Indies often accompanied by thunder and lightning."

SIMOON—"A hot, dry wind, that blows occasionally in Arabia, Syria, and the neighboring countries, generated by the extreme heat of the parched deserts or sandy plains. Its approach is indicated by a redness in the air."

Here we have the five principal varieties of storms. At the first glance at the definitions, together with the past ideas in regard to them, it may seem absurd to some to say that they are all one and the same thing, yet nevertheless on general principles one and the same thing they are—effects from one cause and only varying in minor details as affected by local surroundings. All are caused by the rush of air toward the center of low barometer, or by the ever contending forces, heat and cold. The sun shining on some certain spot and at that point creating an intense heat, and this spot or area of heat from the motion of the earth on its axis ever moving toward the east. The intense heat following the law of physics causes the heated and rarified air to ascend and the cooler air from

around and about to rush in to fill the vacuum, or better, to prevent a vacuum, for we can never have a vacuum in open nature, as in order to secure that we must have some artificial barrier whereby the air may be prevented from entering the would-be vacuum. The vulgar phrase "just before she does she doesn't," well represents nature in her struggle to create a vacuum. With her, to attain the object that she is ever striving for is an impossibility, and through this impossibility she accomplishes other and greater physical phenomena that keep her ever fresh and impart renewed vigor to her numerous and varied subjects.

The "Typhoon" is the center of the area of low-barometer, or the center of the storm, for it is only at this place that the direction of the wind may be upward from the earth, whirling clouds of dust, the center being the point where the "whirling," if any, takes place as well as the "upward-motion." For at the center is where the winds from all points of the compass on all sides of the storm must meet. I was once in the center of an area of low-barometer in the Gulf of Mexico. The wind was from every quarter and had this whirling motion here spoken of—the upper part of the main-mast of the ship was instantly, in the twinkling of an eye—twisted from its place, where it had been so firmly held by the strong shrouds.

Could we have an ample number of stations in a country where these "Typhoons" are said to occur, we would not only see this effect at its very center, but at a great distance, from all sides, see a rush of air toward the spot where this commotion takes place. The "Typhoon" is more apt to represent the peculiar and intense features of an area of low-barometer in hot or equatorial countries. Still the cause and principles that govern it are not different from the "Tornado" which is the name universally given to severe storms that are liable to occur everywhere, and in the United States occur most frequently in our western territory, although not confined there, as such storms occasionally visit New York and New England. To fully understand the Tornado, one must bear in mind the fact that wind under the pressure of a hundred miles an hour or more, will become quite solidified and will bear along with it objects of great specific gravity. In this respect it much resembles water in great and forcible commotion, as in a storm or freshet. We well know that stone is not buoyant in water when the water is in its normal condition, yet when great storms occur along our Atlantic coasts large stones of three and four tons weight are borne from their places in sea-walls and transported quite a distance. When that dam gave away in Connecticut, some few years ago, stones of immense weight were transported upon the condensed floods for a number of miles.

When a Tornado takes place, the air rushing along a narrow way and being condensed by its great speed becomes, as it were, a thing of life and may even, and does frequently represent an immense serpent going over the ground—dirt, stones and loose materials generally, that lie along its path being swept along with the mighty current. But we are told, that the Tornado has a whirling processive and even bounding motion. This is not at all strange. Unimpeded air, or what may

be practically termed such for the time, becomes solidified in proportion to its speed—the greater the speed the more solidity. Then the greater the solidity the more it becomes a thing of life and acts like a living thing. If then in its course it meets with any stationary object it is more or less twisted and turned by that contact, which will readily account for those gyratory motions that belong to this degree of storm and are so often characteristic of it.

How account for the water that so often forms a part of it? may be asked by some. The response to this is, that being wet or dry is merely accidental. But I will pass on to the Cyclone, and take up this point again further on when I come to speak of the late Tornado (of April 18th) in Missouri.

The Cyclone as defined by Webster as being "a rotatory storm or whirlwind of extended circuit" is nothing more nor less than the center of the area of low-barometer. The size of the circle makes no particular difference—the lower the barometric pressure the more severe the storm will be, and as the winds meet at a common and moving center, from equatorial and polar regions or directions, a rotary or circular motion will be imparted to the winds at this point, and their twirling or twisting power will be in proportion to the power of *low*.

The Hurricane seems to be recognized as something peculiar to hot countries. It occurs from the same cause—concentrated heat—and the greater the heat the more powerful the generated force. That it should be accompanied with thunder and lightning is not at all remarkable; indeed it would be more remarkable if it were not thus accompanied.

Wherever there is heat and moisture there will be lightning and thunder. I place lightning first for this is the order in which it should come, the reverse order is the universal practice in using these words simply for euphony, but if we speak of them in the order in which they take place, the *lightning* must take the precedence over the *thunder*. Wherever there is sufficient heat and moisture to form clouds, lightning will be sure to follow, for it is nothing more nor less than a subtile form of heat. This will readily account for the fact that lightning is more the product of warm countries than of temperate ones, and that we in temperate climates have it, with some exceptions only in the warmer months of the year and when it occurs in the winter it is only when we have a remarkably warm spell of weather for the season. So it is not surprising that the Hurricanes of the East and West Indies should be accompanied with thunder and lightning, but rather it would be more surprising if such were not the case.

The Simoon is simply what may be termed a *dry-storm*. It occurs in dry countries where there is little water to generate clouds, and by the way, rain is purely accidental. On all satellite bodies, such as our moon, all the storms that occur there must be after the order of Simoons. If large bodies of water, in the form of lakes and streams, together with extensive woods, could be interspersed throughout Arabia and Sahara there would be no more Simoons there, but they would have just such storms as occur in countries that are well watered.

It is said that the approach of the Simoon is indicated by a redness in the air.

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It is very natural that such should be the fact, for in such countries there is always an abundance of loose sand to be taken up by the wind. A friend tells me that he has seen these clouds of fine sand three hundred miles at sea, off the coast of Africa and that the steamer which he was in, was fully a day in passing through this immense mass of fine dust that had been forced by the winds out to sea.

Always when such storms as the late one in Missouri occur, far more comment is made over the mere auxiliary and accidental things than over the germane cause itself. "This storm took up trees by the roots—another demolished houses, fences, killed animals and people—another filled the air with debris—men and horses were taken up in the air—it rained frogs and toads, ashes, dirt, stones etc., etc.—The tornado moved like a huge serpent—a blackened mass—moved in a very narrow path, destroyed this house and just grazed or bounded over that one. The tornado of such a date moved along the earth, carrying everything with it. One of another date took things heavenward and terrible thunder and light ning followed in its course."

We see the same diversity in storms at sea or in great freshets, and yet storms and freshets are not much unlike each other. The same cause that produced them five thousand years ago produces them now, and will continue to produce them so long as our physical condition shall be under the laws which governed the earth at creation and that govern it now.—Though the principles are the same and universal, the details may and will vary with the localities and surroundings. And so with storms in general, whether on sea or land, and whatever lies in the path of the storm will be demolished, unless it be strong enough to resist it.

Wind moving at the rate of a hundred miles an hour will have an immense force and will not permit things, whether they be trees, toads or stones, to lie around loose. If in the way, they will be taken up on the wings of the wind and be borne along until the force of the wind so abates as to be unable longer to carry them, and if perchance it be near the center of the area of low-barometer, they may be carried upward with the ascending waves of the meeting of the currents.

In this country hardly a summer passes, but that we have from one to three or four severe storms, here generally called "Tornadoes." The term or name matters little.

The papers on the 19th of April, 1880, reported a severe storm of this kind the day previous centering mostly in the south-western part of Missouri, but quite extensive throughout the state of Missouri and parts of Kansas. One of the reports of the storm states, that everywhere along the track of the tornado was evidence of a wave of water flowing in the rear of the clouds, and that these waves or currents flowed in greatest volume up-hill, as though there was something very surprising in this fact. Water will naturally run down hill, but if there be sufficient force behind it, it may be forced up to the top of the highest elevation that the earth can produce. When a hill lies in the path of a tremendous wind-storm, it is similar to a rock or fixed object in a stream where there is an immense and rapid

current. The water will play about the obstacle if it is unable to carry it along with its force. And so with a hill in a terrific storm of wind and rain. Clouds as well as other things will be swept along with the current and where there are clouds there will be moisture, and the more clouds the more moisture, for clouds are nothing more nor less than suspended moisture, and the denser they become by the powerful squeezing process of the winds, the more apt are they to deposit that moisture and that moisture itself to be carried along as a river in the air.

Another party in discussing this tornado of the 18th of April, repeats the old idea about the cause being the meeting of two waves of air at different temperatures. Notwithstanding the firm belief in this idea, I pronounce it as ridiculous as the absurd notion that the moon affects and causes changes in the weather of our globe, and assert that a more false scientific idea never existed.—And more, I challenge proof in support of either this idea or that the moon has the least possible effect upon our weather system. What gave rise to this idea was evidently the condition of the air at the center of the area of low-barometer. Here such currents must necessarily meet, as cold and warm water might meet in a valley where one stream came from some boiling spring and the other from the melting of ice and snow on the mountain top, but the meeting of these warm and cold currents of air or water would not be the cause of any destruction that they might cause on their passage thither. The cause of the destruction would rather be owing to the rapidity with which they rushed to meet each other in this common center, on the steepness of the hill whereby the force of gravity is accelerated, or the rapid displacement of air by the power of heat at the center of the area of low-barometer.

Then there are people who somehow or other believe that "electricity" is and must some way be the cause of these severe storms, and indeed they go so far as to hold that some are *electrical* and that others are not, but are due to some other cause—but *what*, they do not know. Now the presence of electricity in these storms is purely accidental. The hotter it is the more heat will be taken up with the water that forms the clouds, so the more heat taken thus up into the air, the more electricity will there be in the air to generate the flash and light we call *lightning* and the noise we call *thunder;* which are, as I will repeat, merely auxiliary to the storm and not even essential to it, much less being the cause of it.

In all the comments in the papers thus far I have not seen the slightest allusion to the real and simple cause of this storm of the 18th of April, and the only cause of all storms of whatever nature and local peculiarities and wherever they may occur, whether at the equator or at the poles, or in Asia, Africa, Europe or America.

According to the daily weather map, published by the U. S. Signal office at Washington, at half-past seven on the morning of the 18th of April, 1880, the area of low barometer centered at about Omaha, Nebraska, nearly due north of the place where the storm of the afternoon of the 18th is noted as first starting.

Twenty-four hours later the center of the storm was at Lake Michigan, near Milwaukee, Wisconsin. According to laws heretofore referred to in these articles, the area of low barometer starts in the United States in the West, at least there is where we at present first get track of it in its passage across our continent, and as it travels east trends more or less to the north. This area of low barometer of 18th of April, 1880, traveled in a line very nearly *east-north-east.* The first starting of the storm on the afternoon of the 18th of April, is reported to have been near Fort Smith, on the Arkansas river, in the western part of Arkansas, and that it moved in a northeasterly direction. The next place of importance where it struck is reported to have been Marshfield, Missouri, while the storm, though with less force, also raged in and about Kansas City, Missouri.

Now, if one will study the map, he or she will see that the course of the storm was from the places and localities injured by the storm toward the path of the area of low barometer. Here is the simple and universal cause of all storms of this nature—a cause and effect that any one of ordinary intelligence may readily understand if he will only heed the signs. If the intelligent will not heed the signs, why, then they will be as much in the dark as the ignorant, and if anything more so. And so it is not surprising that we see published in respectable papers such ideas as that there was a similarity between the storm in Kansas and one in the Island of Sicily, in the Mediterranean, two days afterward, and that therefore both were of meteoric origin. "The Kansas dust was composed of brown and black impalpable matter, and so abundant that on the next day traces of the deposits could be seen on the surface of the ground, and on a north porch sufficient to receive the imprints of a cat's feet" * * * The near coincidence of dates between the phenomenon in Sicily and here (Kansas), with an apparent similarity in the physical properties of the dust, might suggest a common origin."

In the first place, I would like for the author of the above to publish to the world what a "meteoric" storm is; how it is to be distinguished from other storms; what are its peculiarities; what its general nature, and whether it is dependent upon the influence of the properties of high or low barometer, or quite independent of them. In the next place, if he knew any thing about the rapidity of storm centres, or the speed at which the areas of low barometer, which causes the storm, travels, he would have seen that it could not possibly pass over such a distance in two days, as from Kansas to Sicily, and more than this, that it is very doubtful about an area of low barometer which passes over Kansas traveling in such a direction as to pass over Sicily, or take any such like of latitude as Sicily in its course.

The area of low barometer travels with greater or less speed, probably anywhere from three hundred and fifty miles to even double this distance a day. The force or rapidity of the wind toward the center of the area of low barometer has nothing directly to do with the rapidity of the area of low barometer, but with its intensity. Relatively to the storm the area of *low* is stationary. Then as to

the direction of the winds in such storms this is purely accidental, though in America these winds are mostly toward the east. I say *toward the east* rather than *from the west*, for the reason that winds are pulled and not pushed—the force that creates them is always in advance and not behind. These storms, though generally toward the east are not always so; it depends on the location of the area of *low*. When the area of low barometer is on the land, the storm almost always follows this course, for it is natural that the greater force of the wind must be in the track of *low* as it advances toward the east from the west. For in this case we have not only the force of the wind in proportion to the intensity of this area of low barometer, but we undoubtedly have added to this the progressive force of *low* as it advances toward the east. So our tornadoes are mostly in the track of a storm toward the east—most, but not always, for some times, more especially when the area of low barometer is on a high line of latitude, the storm takes place or begins with a southeast wind. This at first may seem contradictory to previous statements, and so also may the statement that, relatively to the storm the area of *low* is stationary, but with a little study of the weather maps in connection with storms it will be seen that the wind is ever changing as the area of *low* is passing over the country. In the east first the wind will be toward the west and to the south or north of due west as the area of the advancing *low* is on a low or high line of latitude—then, after the passing of *low* more or less reversed, or toward the east. To understand this better, let any one take a sheet of paper and mark its four sides—North, East, South and West. Over the paper sprinkle some iron filings. Then, near enough to attract the iron, slowly draw a magnet from the west toward the east. It will be seen that the magnet will attract the particles of iron as it advances, and from all quarters, and that as it advances it will take up particles of iron with it, and that relatively to the iron the magnet is for the time being stationary, though the particles of iron will follow the movements of the magnet. This, so far as iron will permit, is a fair illustration of the attraction or pulling power of *low* over air, though iron being a far more inert substance than air, is not so readily or extensively affected by the magnet as the air is by the attractive force of *low*.

Then, as to the direction of the wind in a tornado, instead of being toward the northeast, or toward the northwest, it may in some localities be from the northwest, as in Washington, July 4, 1874, and yet in the track of *low*. A south west wind had been blowing all day—or in other words *toward* the northeast. Suddenly the wind changed to the northwest and blew a terrific storm that uprooted trees and unroofed houses in this locality.

In the early part of November, 1877, we had a similar storm on Long Island Sound, when the steamer Massachusetts, being caught by it on a lee shore, came near being a total wreck. In these instances the cause was the same as created the late tornado in Kansas and Missouri, only the area of low barometer was in another locality, and, therefore, the wind that caused it must be from a different quarter. It was in the track of the area of low barometer.

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After all this comment on what a tornado is, the question arises, is there no preventive? There would seem not, at least at this present state and power of understanding. We may, however, ameliorate the force and concentration of the storm by the abundant planting of trees, which will have a tendency to break the force of the storm.

In conclusion, I would remark, or perhaps better, repeat, that the area of low barometer is the center and generating influence of the storm—the center toward which the winds from all quarters will blow, and the force of these winds will be in proportion to the intensity or lowness of pressure at this center of *low*. This area of low barometer is ever on the move toward the east or toward the advancing sun, and its motion, at least so far as we know on land, is never reversed, although there is some probability of its changing its course on the ocean after passing off the land, as discussed in former papers. But its course on the sea, at least after passing off our coasts, is at present unknown to us. We only know that the wind is always toward *low*, and that in passing off the coast, more frequently than otherwise, the wind after just having been from the southwest, comes out from the northwest.

In order to fully explain this, we must have some stations out on the ocean; either stationary, as a light-ship, or movable, as a steam vessel might be. When this can be accomplished, we can study the direction of *low* after passing off the coast; until then we can not be certain as to its location beyond what inference we may draw as to the direction of the wind. We do know that the wind is always toward *low*, and furthermore, that tornadoes, hurricanes, or by whatever name we may call a storm, it always will be in the wake or track toward this center or area of low barometer, wherever it may be, and that a tornado is always in order after the passing of *low*. Fortunately for us, the conditions of nature are not always favorable to it; if they were, we should have them at least once a week, and sometimes oftener.

What becomes us now is to carefully study out the course of *low* every time it passes over the country, note the conditions when a tornado occurs and when not. By careful noting of data, by and by we may be able at least to say when one will occur and when not, and as we advance in knowledge, we may, by the judicious planting of trees, or by other means not now plain to us, in a measure prevent their occurrence, or at least diminish their severity or intensity.

AURORA BOREALIS.

PROF. E. R. PAIGE.

The cause of this singular phenomena has been a prolific subject of both scientific and unscientific discussion for many years.

To the mind educated in cause and effect the canopy of night, lighted up by the dancing specter, presents a most alluring sight: while the unenlightened are

filled with dark forebodings of a visitation of God's wrath, the scientist sees only the grand workings of the immediate laws of nature.

The heavens illuminated with red light is to the superstitious a sure harbinger of impending wars: while the careful observer looks with delight upon the scene, and is impressed only with the sublimity of nature, poor unreasoning man is tortured with fears of coming evil.

In the slow development of scientific knowledge, many and varied have been the theories put forth as to the origin of the Northern Lights, as we in this hemisphere call them. It is the reflection of sunlight by the ice at the pole, says one, while another contends that it is produced by great and internal fires whose chimney occupies the space devoted by Dr. Kane to an open polar sea; but the more patient observers have pronounced it electric light. It is my present purpose to look out through the light of a few known facts in search of the origin of this great wonder. Not that any direct good will follow a successful inquiry in the matter of utilizing the light for street purposes or for private illumination, but if we can find the cause to be natural, and not supernatural, then one more old superstition that has haunted the memory and made life unhappy is gone—one more bugbear of tormenting fear is consigned to the shades of past ignorance. Newton discovered the law that controls the universe, and every child should be taught this law, for without it we can comprehend nothing in nature. How life is produced, how worlds, how suns, and planets formed and held in their orbits, is known only through this law.

"Each atom has an attraction for each other atom in the universe, and the attraction is proportionate to their size, and is lessened as the square of the distance which separates them increases." Late developments in scientific research lead to the conclusion that all the varied original elements in nature, so-called, are resolvable back to one, and that one to energy. Also that light, heat, electricity and sound are only different phases of motion.

Heat is the arrest of motion, and all the warmth we get from the sun is produced by the stoppage of the heat waves sent out by its throbbing power. Chemical heat is created by the clash of little worlds of gas beating together, and no exception is known to the rule, that heat is the arrest of motion.

All the heat and all the energy we get on the earth come from the sun. The rainclouds are lifted from the ocean; the winds sweep over the mountains and across the moors, the blood of life, the sap of vegetation, all propelled by the power of the sun. The visible power expended on our little globe passes all efforts of comprehension, but it is naught compared with the latent hidden energy. The decomposition of one drop of water produces a power equal to the most terrific thunder storm ever witnessed, while the decomposition of one grain of water produces a force equal to the discharge of 800,000 Leyden jars. All this but shadows the vast amount of energy that comes to us from the sun. Our earth is but a speck in space, and not a two thousand-millionth part of the energy thrown off by the sun strikes us, but is expended out in dark, empty space. This in-

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volves a vast waste by the sun, and experiment shows that the sun would be exhausted and cooled down in 5,000 years if not replenished from some source. The earth is passing around the sun once a year over a path 555,000,000 miles long, traveling at the rate of 68,000 miles an hour. The speed of our flight is eighty times more rapid than the swiftest flying cannon ball. If the globe should strike a dead wall passing at this great speed, the concussion, we are told, would burn it instantly, creating a heat of which we have no comprehension; and yet the heat produced by such a catastrophe would not be sufficient to last the sun's waste for a period of thirty days.

We are taught, however, that if the earth should let go its place in space and be attracted into the sun, that body, being 325,000 times more than the earth, and, therefore, possessing 325,000 times more power of attraction, its immense pull would draw us in with such a velocity that the kinetic force gathered in the passage would produce an impact in striking that would give off heat sufficient to last the sun's waste for a period of ninety-one years.

In any hour of a clear night that we watch we shall see at least six or eight stars fall. These stars are simply small pieces of iron gathered and formed in space that have fallen into our atmosphere in our flight around the sun; that is, have been attracted into the orbit of the world and picked up. Coming into our atmosphere when it is passing with such velocity creates a friction—a concussion—an arrest of motion, that immediately burns the iron. We see the explosion and call it a falling star. If an unaided eye can see six fall in one hour of the night, then what a vast shower must be constantly attracted by the whole earth. If the little earth with its slight power of attraction brings in such a constant shower of cosmic matter, how much more would be attracted by the sun, possessing 325,000 times more power of attraction than the earth. Such is the case, we are told, and our grand constant shower of cosmic matter is constantly falling into that body, forming a vast corona extending out from the sun 800,000 miles, by the clashing and impinging of particles aad resultant burning. Thus, by virtue of the law of attraction, one constant stream of matter, which is energy, is pouring into the sun to replenish its waste. This matter must be formed in space, and is simply an aggregation of energy, or fire-mist, that pervades the atmosphere.

The cosmic matter that falls on the earth, that is meteoric matter, is about 85 per cent. iron, and is merely an aggregation of iron-dust, which is itself an aggregation of invisible fire-mist. Great clouds of this fine iron-dust gather in the heavens, and are occasionally attracted into our orbit. On striking our atmosphere, flying with such great speed, the concussion, the arrest of motion, instantly burns the iron-dust and produces light colored according to the surrounding conditions that produce the refraction. This theory is not without its objections, and the chief one is perhaps the fact of these lights occurring toward the poles. This objection, I think, can be met, however, in the conditions that produce refractions of light, but our article affords no space to enter upon that field.

The facts I have alluded to as a basis for reasoning are, of course, not my own, and I shall not be deemed immodest, I hope, in saying that they are all well established and may be accepted as true grounds of reasoning.

This being so, it does seem that the wonderful aurora borealis may be fully accounted for in the burning of iron-dust that gathers into great clouds, and floats into our flying atmosphere to be burned by the concussion.—*Inter-Ocean.*

PHYSICS.

THE MANNER OF WORKING THE ELECTRIC TIME BALL.

PROF. C. W. PRITCHETT.

Dr. Case:—In an editorial note in the last number of the Kansas City REVIEW, attention is again called to an electric time ball for the Union Depot, Kansas City.

Since June 3, we have transmitted to the Union Depot, by the Western Union telegraph, a daily time signal, at 4 P. M. The manner of sending it is as follows: At about five minutes before four o'clock we call Union Depot and advise the operator of the nearness of the signal. This is also a monition to all other operators to keep off till the signals are sent and acknowledged; and by special instructions from the Superintendent, they are under obligation to heed this monition. At the proper moment, one of the brake-circuit clocks of the Observatory is instantaneously switched into the line through a relay, and begins to record each of its seconds, on every sounder between Mexico and Kansas City.

The first second marks 3 h., 59 m., Kansas City mean time.

The sixtieth second marks 4 h., Kansas City mean time.

The 120th second marks 4 h., 1 m., Kansas City mean time.

The sixtieth second is specially distinguished from all others by an extra break, interpolated by hand before it and also by a like extra break immediately after it. There are thus three chances for the operator to get the exact second, if any interruption occurs. I am glad to say that, generally, the signals are allowed to pass uninterrupted. Sometimes, however, they are marred by operators either through forgetfulness of instructions, or through ignorance of them. I am reluctant to believe that they are sometimes interrupted through mischief. On several occasions keys have been left open, or the line has been down or grounded, and hence the signals have failed.

A word as to the accuracy of these signals. In sending them the difference of time between the Meridian Pier, of Morrison Observatory, and the Union

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Depot, has been assumed to be 7 m. 5s. This difference is probably correct to within one or two seconds. It has been deduced from actual measures, in which the effect of convergency of meridians, and the spheroidal figure of the earth has been duly computed. It is desirable, as early as possible, to determine the exact difference of time, to within a small fraction of a second, by time determinations made on the ground and by exchange of clock signals by telegraph.

The signals themselves are always correct to the nearest half-second of the clock. The error of the standard clock is daily ascertained by standard stars. Fractions of a second cannot be sent out by the clock itself, unless a Hack-clock be used, and set to the fraction of each transmission.

Now, a word as to the proposed time-ball. It might be a public convenience, and at little expense; and by a little adjustment and punctuality it could be made a visible indicator of correct time for thousands. It is entirely practicable to drop it from the Observatory; but in view of liability to interruption it would be safer for the operator at the Union Depot to do so by touching a spring at the first extra-break of the four o'clock signal. A light elastic hollow ball, several feet in diameter, and having the figure 4 conspicuously painted round the the margin of a great circle, could be easily run up a staff by a cord a few minutes before the time, and could be made to descend instantaneously at four o'clock, by the simple touch of a spring. I simply suggest this. We send the signals and leave it to others to make them as useful as possible.

Very truly yours,

C. W. PRITCHETT.

MORRISON OBSERVATORY, July 15, 1880.

NOTE.—The time-ball at New York is dropped by the first break of the Washington clock. To prevent interruption from operators, the operator at New York presses against the armature of his relay, until a few seconds before the signal.

THE ELECTRIC RAILWAY.

Now that the possibility of an electric railway has been fairly put before the public by Dr. Siemens, we may expect to hear more about it before many years.

The commercial advantages of the system must, of course, determine whether the Electric Railway will be extensively used or not. The question is not entirely one of economy of fuel; safety and convenience are elements which greatly affect the commercial profitableness of any undertaking, and these must be taken into consideration in making an estimate.

As yet, the new means of locomotion has only been experimented upon on a comparatively small scale, but the results have been quite sufficient to justify a favorable conclusion being drawn.

The idea of an electric railway is by no means new; little model engines, which ran backward and forward on a pair of rails, or round and round in a circle, were often to be seen in the windows of the shops of scientific instrument makers in the early days of electrical science, and the suggestion to apply the

principle on a large scale was such a natural one that it is necessary to go back to a somewhat early date in the records of the Patent Office to find the first patent for an electrical railway. So long as the motive power was dependent upon galvanic batteries but little success could be obtained, but the introduction of dynamo machines altered the question entirely and brought the idea within the range of economical possibility.

For underground railways the system is specially suitable, and those who travel on the Metropolitan railway during the dog days must often devoutly hope that some change in this direction will be made at no distant date. Already it is contemplated to work the traffic through the new St. Gothard tunnel by electricity, and plans and designs for the purpose have been in hand.

Railways worked by electricity will, however, have to compete with a formidable rival in the shape of railways worked by compressed air locomotives. This latter means of producing locomotion appears to have waked up again and is likely to have considerable employment.

For very short distances, where the traffic is heavy and irregular, as for instance, on the small branch lines used so frequently in mining districts, the electrical railway could be used with great advantage, especially if natural sources of power were available.—*Telegraphic Journal.*

GEOGRAPHY.

PERSONAL RECOLLECTIONS OF ORTON AND PERU.

BY DR. I. D. HEATH, WYANDOTT, KANSAS.

(*Concluded.*)

The mosquitoes are excessively numerous and annoying. Sleep is absolutely impossible without netting. Each Indian and traveler carries with him a toldeta or small cotton tent, three feet high, three feet wide and seven feet long which he sets up by means of small sticks. The Indians brought to us gums, resins, dye woods, medicines, barks and herbs and textile plants.

Trinidad, a place of 5,000 in a beautiful grove of tamarind trees, is the capital of the Department of the Beni, and a place of considerable trade and business. It is on the margin of the immense grassy pampas of South America where graze countless herds of fat cattle. Imports consist of every class of manufactured American and English goods. All goods into Peru and Bolivia by way of the Amazon enter duty free. Exports are hides, coffee, chocolate, beans, tobacco and, from down the Yacuma river, rubber and Peruvian bark. Rice, corn,

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sweet potatoes, sugar, rum and all tropical fruits are produced in abundance. Fresh beef retailed in the market at 2½ cents per pound. During the month of May, we found the temperature to range from 61 to 86°. The cathedral here is said to be 180 years old. One of the bells had cast in it the date 1729. During our stay in Trinidad the feast of the Holy Trinity was celebrated—the patron saint of the city. Three days and three nights Indians, dressed in magnificent feather robes of brilliant colors, danced in front of the cathedral. Their heads were covered with a cap supporting long feathers of the macaw, feathers three feet long which were arranged to represent the rays of the sun, the object of their former worship. A few made music from drums and from thigh bones of large birds pierced with holes for flutes. Other Indians were armed with knives, tomahawks and war clubs. The Indians kept step to the music, brandishing their weapons and slowly advancing to the open door of the sacred building from whence they would suddenly and quickly retreat to the plaza and then again slowly advance. On the third day hundreds of men and women dressed in long white robes marched in procession from the church bearing the life-size images of the virgin and saints. As soon as the image of the virgin appeared outside, those representing the ancient religious rites fled in fear and dismay.

The birds here are very plenty and extremely beautiful. Fifty were shot and their skins preserved. Little groves of the fan palm are a pretty feature of the pampas. In places are numerous ant-hills four to six feet high. There is little industry; the ruling classes are Spaniards, gentlemen, and must not work. The Indians perform the labor and receive $3 to $4 per month.

Here the Professor bought and paid for two barges of three and four tons each, equipped and provisioned them for three months. The provisions were charque, a kind of dried beef, farina de yuca (our tapioca), rice, sugar, coffee, chocolate, sugar, molasses, yuca and plantains. He hired a crew of eleven Canichana Indians and another crew of nine Machupos. For the protection of all he engaged ten Bolivian soldiers, paying their salaries. He disbursed $1,200.

On the 1st of June we set out and once more voyaged down the Mamore river—our general course due north. We passed by pampa and forest, by cattle and sugar estates, by plantain, orange and chocolate orchards and groves of tamarind trees.

We stopped a day each at San Pedro, Santa Ana and Exaltacion, where the Professor made observations for the determination of altitude, latitude and longitude, as was also his practice at every important point. We hunted the ostrich and tiger, wild turkeys and water birds and made collections of everything interesting to science. Wild turkeys and fish are in great abundance. We were enjoying a delightful climate, floating or paddling down this great river, one and two miles wide and at this season of the year of unknown depth. Everything was new, strange and interesting. There were more than fifty varieties of palms, more than fifty of beautiful cabinet woods. What destiny would steam and modern civilization work out for this country? What new resources might not science discover?

Why may not benevolent societies be organized in every Christian nation of the world for the purpose of transporting the starving millions of Persia, India and China to the fertile plains and Italian skies of the great Madiera plateau of South America? a country that could never be wanting in beef, rice, plantains, corn and fish.

After fourteen days of paddling we reached the rapids of Guajaramerim in Brazil, only eight leagues distant from those unexplored lands, the object of our long and expensive journey. Here the soldiers mutinied, and, with charged muskets leveled at the Professor's breast, deserted us, taking away with them one-half our outfit. Slowly we made our way back up stream to Santa Ana and there changed to ox carts and saddle horses for a journey of 200 miles west through the cattle estates of the pampas. The country is nearly level and its general appearance much like of the prairies of Illinois previous to their settlement. Our route was not distant from the timbered line of the river Yacuma. Other pieces of timber were seen and clusters of the graceful fan palm. It is a beautiful, quiet, pastoral country. Each of the carts were drawn by two pairs of oxen yoked together after the Spanish method by straight sticks fastened with thongs back of the horns. The carts were entirely of wood, well made, without one particle of iron in their construction. Upon the carts were placed boxes of rawhide for the reception of the baggage so that while crossing the many streams that drain the pampas, the Indians, oxen and carts were all swimming at the same time.

At the time of our visit cattle were reckoned scarce and high-priced. A few years previous they existed in such vast numbers that the government at La Paz sold permits for their slaughter at $1 per head of those not branded. Millions of cattle were killed for their hides and tallow. In 1877 a cattle estate, land and all, was valued at eight pesos ($6.40) per head for all those over one year of age. Tigers are greatly feared and are destructive to young stock. Each estate keeps twelve to fifteen powerful dogs to watch and fight the tiger whose skin will cover as much ground as that of a cow.

In the latter part of July we arrived once more in sight of the mountains at Los Reyes. At this point is he who addressed you two years ago on "Peruvian Antiquities"—Dr. Edwin R. Heath. He arrived in Los Reyes last September by way of the rivers Amazon, Madeira and Mamoré. He is engaged in studies and making collections in the interests of science and getting ready an expedition to work out the unfinished task of Prof. Orton—an undertaking full of difficulty and danger—but for the accomplishment of which he possesses the experience of those who have gone before him, a long and intimate acquaintance with the Spanish character, language and of their country, and an indomitable energy; and if he fails in the task before him it will only be from want of sufficient funds.

But to return to the expedition of 1877. Arrived at the foot of the mountains the next two stages must be made on foot—180 miles. Engaged sixteen Indians for the baggage, each one carrying sixty pounds besides his own food and

blankets, and traveling six to eight leagues per day. The Professor bought a saddle mule which on the third day, while being led around a dangerous place, slipped and rolled down out of sight, dead. Out of 170 head of fat cattle that started for Apolobamba over the same road at the same time with ourselves 130 were lost by accidents on the way.

Both ascending and descending this eastern cordillera we saw the Cascarilla and Peruvian bark tree newly stripped. One species with leaf as broad as the hand is found up to 5,000 and 6,000 feet, and another having leaf the size of an apple leaf grows only at greater elevations. The gathering of the bark is a destructive one, and the tree has almost entirely disappeared from lines of travel. We met many Indians loaded with bark. The Indians constantly use coca leaves with which in the act of chewing they mix ashes of a palm nut. They claim that it allays hunger and fatigue. Professor Orton, sick and almost utterly exhausted, drank hot infusions of coca two or three times daily and declared for it marvelous power to restore his strength. The mountain scenery over this route is magnificent, and is called the Switzerland of America. Mountains 6,000, 8,000 and 10,000 feet in height with intervening valleys all densely wooded, and rich with the deep green of the tropical forest. Of one view the following was written on the spot: Not far from Mamacuna we have our first clear unobstructed view in the west of the central cordillera stretching away from north to south as far as the eye can reach. In the foreground and all about are mountains 7,000 to 10,000 feet in height, but high up above for a magnificent background stands this dark barrier with its white crest of snow and ice reaching 18,000 to 20,000 feet up in the sky. No mortal ever saw a grander sight. Professor Orton declared it the most splendid view he had ever seen. We could stand here all day, but the silent Indians were moving on.

Apolobamba, 2500 inhabitants, in valley of same name. Coffee, corn, yuca, potato, plantain, oranges, pineapple and sugar cane. Sixteen days in Apolo. Last of August and first of September. This valley is noted for its coffee. The bushes stand six feet in the row and rows eight feet apart. We saw them in full bloom. There is nothing of the kind prettier—long, slender stems, leaves opposite and drooping, and at the axiles of the leaves long rows of erect clusters of pearly white flowers. Near Pachimoco there were three coffee trees as large as apple trees, said to produce annual crops of seventy-five pounds to each tree.

Throughout Peru and Bolivia there are many commercially educated Germans, who almost invariably speak four languages. At Apolo, we dined with Don Carlos Frank, a German dealer in Peruvian bark, who spoke correct English, Spanish, French and German, to his guests at the table, and Quichua to his servants. He was paying $32 per 100 pounds for poorer qualities, and $80 for best qualities of bark.

Mules again to Pelechuco, 41 leagues. Pelechuco, 10,500 feet elevation, in the Quichua, signifies "Corner of the mist," because from its peculiar position at the head of the valley and just under the snow peaks, the town is much

of the time enveloped in cloud and mist. Temperature at mid-day 48° Fahrenheit. Mules and llamas do the freighting. Llamas are driven very slowly, sometimes in great herds. They carry seventy-five to one hundred pounds, and are valued at $4 to $5 each. September 18th, we crossed the summit in the midst of mountains of snow—temperature 24°—and thence by easy roads descended the valley of the Escoma to Lake Titicaca. Along this valley at an elevation of 13,000 to 15,000 feet, saw, millions it might be, of alpacas grazing—prevailing color black. At last, after six months of out-door life, we embarked in the schooner Aurora for the city of Puno. The Professor dropped down on a heap of sail cloth, exclaiming, "I am so glad! so glad! We'll have no more mules, muleteers nor Indians, no more annoyance, trouble or disappointment. I am so tired! so tired!" and quickly fell asleep. Just before daylight of September 25, after a night of unusual storm, he became conscious that he was dying, and there, among strangers, whom, twenty-four hours before, we had never seen, on the highest navigated lake in the world, 13,000 feet above the ocean, far away from wife, children and friends, calmly, quietly, without a struggle or a word of complaint, he died.

But his final resting place is a glorious one, eminently befitting his life and career. It is upon the summit of a rocky island in Lake Titicaca, many thousands of feet nearer the sky than are most sepulchers. There he lies in sight of the scenes of his last explorations; upon one side is discerned the last mile of iron rail and telegraph, and on the other, that mysterious lake and island from whence issued the great Inca monarchy.

As he himself wrote in memoriam of Col. Stanton, a companion in a former expedition, who was buried in Quito: "He was buried without parade, and in solemn silence—just as we believe his unobtrusive spirit would have desired. No splendid hearse nor nodding plumes; no long procession save the unheard tread of angels; no requiem save the unheard harps of seraphs. Snow-white pinnacles standing around him on every side, we left him in this corner of nature's vast cathedral; secluded shrine of grandeur and beauty, not found in Westminster Abbey."

At this time, with Professor Orton, died Mr. Henry Meiggs. Every station, engine and car, was draped in the deepest mourning—engine drivers vying with each other in decorations of respect.

They relate many anecdotes of Don Enrique Meiggs, as railroad men call him. Many years ago a civil engineer of rare ability and training, was at work on railroad surveys in Georgia at a salary of $80 per month, when an agent of Mr. Meiggs offered him $125 per month, gold, and free ticket down and back, to go to Chili and make surveys on the railroad to Santiago. He went. Month after month he received his $125, while the other civil engineers received $333 per month. He was advised to break his contract and demand higher salary, but his high sense of honor would not submit to a violation of his pledged word, and so he toiled on month after month and year after year, to the end of his

term—one of the best engineers in Don Enrique's employ. Just before sailing for home he was among invited guests to Mr. Meiggs' residence, and, seated at the table he found under his plate a check for $40,000. Subsequently Mr. Maynadier was chief engineer and superintendent of the Pacasmayo railroad at a salary of $10,000 per year.

Immediately after having taken the contract at $28,000,000, to build the Oroya railroad from Lima over the mountain to the Jauca valley, Mr. Meiggs sought to obtain special freight rates from an English company operating a line from Callao to Lima; this company having obtained the concession from the Peruvian government of exclusive rights for the term of twenty-five years, the new road *must*, necessarily, commence at Lima, and every pound of the immense material *must* come over the English road from the sea port. Mr. Meiggs was referred to the printed schedule figures. On no account would reduced rates be granted. They rather enjoyed their advantage over the successful American contractor. Soon the railroad material began to arrive; it went over the English road and freights were promptly paid. The new road had many miles graded up the valley of the Rimac—several miles of track laid and supply trains running, when suddenly, to the astonishment of all, 1,500 men began to throw up road bed and lay track *down* the Rimac toward the ocean. Of course the English company notified Mr. Meiggs that this enterprise must cease, that it was a direct infringement of their exclusive rghts. Mr. Meiggs said nothing, but his men worked right on, laying a mile of track per day. The Englishmen were amazed and appealed to the government, which formally warned Mr. Meiggs to desist; but still the work went on. Troops were ordered out to suppress this mob of Yankee enterprise, till the matter could receive a judicial investigation, when, at the last moment, Mr. Meiggs quietly informed them that he was building a private road on private land, and that there was no law in Peru that could stop him. Mr. Meiggs had quietly, unknown to the public, bought three haciendas, extending from the Monserrate station, in Lima, to the Guadalupe station in Callao, and in the center of this princely estate, at Villegas station, the tomb of the dead contractor is in plain sight from the passing trains of the Oroya railway.

The mountains are peopled by the Quichua and Aimara Indians, relics of the once powerful monarchy of the Incas. They were skilled in the art of spinning, weaving and dyeing, both woolen and cotten, centuries before the coming of the Spaniards. Even to-day, as they tend their flocks of sheep and alpaca, their hands are busy twirling the distaff and forming balls of yarn, while humming some gentle melody in the ancient Quichua tongue. They wrought in gold, silver and copper. They retain the Quichua language in the family circle—many of them never speaking the Spanish. They publicly profess the Catholic religion, but still have not forgotten their ancient religious rites. They cultivate potatoes, barley, wheat, rear cattle, horses and flocks, and toil in the mines.

In every city there are Italians, Germans, and of course, on the railroads,

Americans and English. One hundred thousand Chinese have been introduced into Peru under a contract for eight and six years of labor. There are now nearly 80,000 free Chinamen who speak the Spanish language, have adopted the western dress and, marrying native women, have settled down as permanent citizens of Peru. As slaves, they are worked in sugar cane and rice fields—and free they are keepers of shops and eating houses and toil upon railroads and in mines. Outside the large cities, the only public eating houses are the Chinese fondas, and these are patronized by all classes.

The material resources of Peru and Bolivia, are enormous. The fertilizer, guano, is found on the rocky promontories and islands along the entire Peruvian coast. The government receives $36 per ton. It is the revenue from guano, without one cent of tax from the people, that has enabled Peru, under the direction of Henry Meiggs, to perform those gigantic feats of railway construction. Millions of tons have been exported, and many millions of tons remain.

From the earliest date, Peru and Bolivia have been famed for their mineral wealth. Gold has been found in many provinces. In the districts of Carabaya and Tipuhuani, mines have been worked ever since the Conquest. Silver is most abundant—probably not wanting in any one of 1,500 miles of mountain range. The silver mines of Hualguayoc, Chilete, Cerro de Pasco, of Puno and others were worked before the Conquest, are still worked, but in the most primitive manner, without machinery—the metal bearing rock being carried to the surface in rawhides on the backs of Indians; each vein being abandoned when covered with water. Quicksilver, copper, lead, zinc, are also mined.

Sugar cane comes to maturity in sixteen months, producing eight to ten annual crops without replanting. For the production of sugar on the coast of Peru, there are no seasons—the sugar mill never stops. During 365 days of the year the cane is cut, when the field first harvested, is again ready for the knife. The mills produce many tons of sugar each day—there are two of the capacity of sixty tons each twenty-four hours. The profits on sugar production are nowhere so large as in Peru.

It is claimed that Peruvian cotton commands a higher price in the London markets than the American, and that the climate, soil and system of irrigation produce fine crops of Sea Island cotton.

Near Pacasmayo, in northern Peru, grows a variety of coffee of such delicious aroma that the entire yield was sold at $1 per pound from the haciendas.

If there is any specific for pulmonary consumption, it is the climate of Peru. A carefully kept record of the temperature four times each day for four years at our hospital in Pacasmayo, gave us 86° for the hottest, and 58½° Fahrenheit for the coldest day—a variation of only 28° in four years. In many confined valleys from middle of December till middle of March—the three months of their summer—the mercury rises to a hundred and over, but all enjoy nine months of our May and September. I believe that every consumptive who possesses strength sufficient to travel, can find somewhere, within one hundred miles, be-

tween the sea bathing of the coast and elevated mountain valleys, a climate exactly suited to his physical condition, in which, among fruits and flowers, with doors and windows ever open, he will enjoy sound health and long life. While in Cajamarca, fourteen persons were pointed out whose baptismal records dated back 120 years and more.

Sugar, tobacco, cotton, hides, wool, bark, and minerals have been offered in such quantities that the P. S. N. Co., commencing with two small wooden steamers, have had built eighty iron steamships varying in size up to 4000 tons each. The greater portion of the immense freight goes to Europe by the Strait steamers. With a ship canal across the Isthmus of Panama, the United States would be able to send a much larger merchant marine to the west coast of South America.

I have read that at the time of the Conquest, the Incas were ruling over a population of 30 000,000 of people. With the American school book, engineer and telegraph, with an exhaustless supply of mineral wealth, a fertile soil and a perfect climate, with swift running steamers connecting her ports with all the world, to what degree of population and wealth may not the Republic of Peru again attain?

ARCTIC RESEARCH.

FROM THE ANNUAL ADDRESS OF THE EARL OF NORTHBROOK, PRESIDENT OF THE ROYAL GEOGRAPHICAL SOCIETY.

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The examination of any part of the vast unknown region surrounding the North Pole is interesting to geographers, and discovery in this direction seems to have a peculiar fascination for maritime explorers. A year seldom passes without some effort being made to add to our knowledge in the far north. During the last summer two voyages of reconnoissance were undertaken in this direction, one by the Dutch under Captain de Bruyne, and the other by our associates, Sir Henry Gore Booth and Captain A. H. Markham, R. N. The Dutch officers actually sighted Franz-Joseph Land, while our countrymen attained a remarkably high latitude at a very late period of the navigable season. I understand that in the coming season, Mr. Leigh Smith, whose name is already honorably associated with Arctic yachting, will make a voyage of reconnoissance, which, if circumstances prove favorable, may become a voyage of discovery. The American expedition, which sailed from San Francisco last year for Behring Strait, is believed to have wintered in the pack, and tidings of it may soon be expected.

I have quite recently received information that the Government of the United States have decided upon sending out another Arctic Expedition, via Smith Sound, under Captain Howgate. This is a project which has been some time under con-

sideration, but has only now been matured. It is intended to make a temporary station for Arctic observation and discovery in the latitude of 81° 40' on or near the shore of Lady Franklin Bay. The expedition will consist of twenty-five people, who are to go up there in the Gulnare, a steamer of two hundred tons. The proposal is that they should endeavor to push on to the North Pole by slow degrees during several seasons. The Board of Admiralty have placed at the disposal of this expedition the depots of provisions left by Sir George Nares in Smith Sound in the years 1875 and 1876, and we shall feel an interest in seeing what our cousins on the other side of the Atlantic may succeed in doing in this matter.

ADMIRALTY SURVEYS FOR THE PAST YEAR.

BY THE HYDROGRAPHER, CAPT. F. J. O. EVANS, R. N., C. B., F. R. S.

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On the seaboard of China, Captain Napier and his staff in the Magpie, visiting the Gulf of Tong King and Hainan Island, have surveyed the Treaty-ports of Pak-hoi and Hoi-how; determined the position of Gmi Chan Island and Cape Cami, including a partial examination of the shoal ground off this headland. Proceeding northward, an extended search for the Actæon shoal was instituted; this reported danger in the neighborhood of the Shantung promontory, and lying in the highway of navigation for ships proceeding to the Gulf of Pechili, having long perplexed seamen; the search, however, was not successful. A comprehensive survey of the entrance of the Yang-tsze kiang, extending from Shaweishan Island and the Tungsha banks as a seaward boundary upward to Buch Island above the Wusung River, including enlarged plans of the outer and inner bars of this river, is also nearly completed.

In Japan, Commander Aldrich and Staff in the Sylvia have completed the Goto Islands; also the west coast of Kinsin from Da Sima to Odimari Bay, including the Kosiki group and the off-lying islands from the western part of Van Diemen Strait. A preparatory triangulation of the coast from Odimari Bay to Cape Cochrane on the east coast of Kinsin has also been made. The charts of the seaward approaches to Western Japan from the ports of China are thus approaching a satisfactory completion.

After six years service on the coasts of Japan, the Sylvia will return to England in the autumn of this year. H. M. S. Flying Fish, an armed sloop, of modern type, will take her place under command of Lieutenant R. F. Hoskyn, this officer having taken an active part in the surveying duties on which the Sylvia was engaged during the whole of her foreign service.

On the western coast of South America, H. M. S. Alert, with an efficient staff of surveyors, in the early part of the year under Sir George Nares, and sub-

sequently under Captain Maclear, has been employed on arduous service, chiefly in a critical examination of the ship channels adjacent to the fiftieth parallel of latitude. Trinidad channel—directly opening into the Pacific Ocean—with Conception channel leading from the inner waters north of Magellan Strait into Trinidad channel, have all been surveyed, together with their numerous ports and temporary anchorages likely to be useful to passing shipping. Innocentes channel, leading to Conception channel from the now well known Guia narrows, has also been examined and charted.

Trinidad channel opens out a clear passage to the Pacific Ocean, 160 miles to the north of Magellan Strait; and although not so secure of approach *from* the Pacific as the well known entrance into that strait by Cape Pillar and the Evangelists, it will be found a valuable addition to our knowledge of these waters, as enabling ships passing into the Pacific to avoid the heavy sea frequently experienced in the higher south latitude. Similar in feature to Magellan Strait, the ocean entrace of Trinidad channel is shoal, having only forty fathoms of water in the deepest part, the depths gradually increasing to 300 fathoms in the inner channels. The southern shores are bounded by bold, rugged mountains, rising abruptly from the sea; whilst on the northern side a low wooded country lies between the sea and the rugged spurs of distant snow-clad mountains; both shores are cut up into numerous bays and inlets. In the latter months of the year very few natives were seen; it is understood that at this season the Fuegians leave the inner waters for the outer seaboard, in pursuit of seals.

During the winter months, the Alert, having refitted at Coquimbo, then visited St. Felix and St. Ambrose islands, and obtained a series of ocean soundings in an area unexplored by the Challenger in 1875 These islands appear to be unconnected with the South American continent, for soundings obtained midway gave a depth of 2250 fathoms (rad. ooze), with a bottom temperature of 33°.5 F, both depth and temperature thus corresponding to the general bed of the South Pacific Ocean. Neither do they join the Juan Fernandez group, for the depths between reached 2000 fathoms. These several scattered lands thus appear to rise from a submarine plateau as isolated mountains. Captain Maclear describes St. Ambrose Island as volcanic, composed entirely of lava arranged in horizontal strata very marked, intersected vertically by dikes of basalt; vegetation is scanty, and the island is without water; though frequented by sea birds, the sides are too steep and rugged for guano to collect.

XUM

PUBLIC SCHOOLS' PRIZE MEDALS.

FROM THE REPORT OF THE ANNIVERSARY MEETING OF THE ROYAL GEOGRAPHICAL SOCIETY.

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The medals have been awarded this year as follows by the Examiners. who were for Physical Geography, Commander V. L. Lameron, R. N., and for Political Geography, Admiral Sir Erasmus Ommanney, F. R. S.; the special subject for the year being "Western Africa, between the Sahara, the territory of Egypt, the Equatorial Lakes, and the sixth parallel of south latitude."

PHYSICAL GEOGRAPHY.

Gold Medal—David Bowie, Dulwich College. Silver Medal—Albert Lewis Humphries, Liverpool College. Honorably Mentioned—Gustave Isadore Schorstein, City of London School; Sydney Edkins, City of London School; Phillipe Joseph Hartog, University College School; Henderson McMaster, Liverpool College; Robert Galbraith Reid, Dulwich College.

POLITICAL GEOGRAPHY.

Gold Medal—Frederick James Naylor, Dulwich College. Silver Medal—Theodore Brooks, London International College. Honorably Mentioned—Charles Theodore Knaws, Dulwich College; Charles E. Mallet, Harrow School; William H David Boyle, Eaton College; Allan Danson Rigby, Liverpool College; Matthew George Grant, Liverpool College; Charles James Casher, Brighton College.

Mr. Douglas Treshfield, said that, in the absence of Mr. F. Gation, the Chairman of the Public School's Prizes Committee, it fell to him, as a member of the Committee, to announce the result of the recent examinations. Before doing so he wished to make some remarks suggested by a tabular statement before him, showing the number of candidates who had submitted themselves for examination in each year, since the prizes were founded in 1869. Such a comparison showed rapid oscillation rather than any steady advance. In 1869 we began with 81 candidates, the number falling, in 1871 to 23. In 1876 the number rose again to 54, and this year stood at 32, which was somewhat below the average. This result must not, he thought, be looked on as discouraging. The large numbers at commencement were doubtless due to ignorance of the nature of the examination, which was not confined to the old-fashioned school topography, a mere list of names to be learned by rote, but aimed at testing the knowledge of boys in scientific geography. To prepare boys for the Society's examinations required considerable attainments in the teacher, and it is not every school, not even every public school, which is fortunate in the possession of adequate instructors. One of the results of the examinations would probably be to supply the first requisite of sound teaching—a number of competent teachers—under whom many schools might rival the successes won for Dulwich and Liver-

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pool Colleges, under Dr. Carver and the Rev. George Butler. There was, he believed, no doubt that the importance of geography as a branch of education, was more generally recognized. Indirectly it fulfilled the first requisites of an educational subject, by inculcating at the same time accuracy in details and the habit of drawing from them broad conclusions. Whatever branch of science the student might follow up, he would find a knowledge of the conditions of the earth's surface, such as is supplied by physical geography, a staff in his hand. In the more prominent, but perhaps lower walks of life, such a knowledge was of great service. In the future, those soldiers who know best their maps, would win most battles. The merchants who best understood physical conditions would make most money, and the nation whose statesmen were scientific geographers would have the most scientific of all possible scientific frontiers. Turning to the detailed results of the last examination, he would point out that of the fifty-two schools which had been invited to compete, ten only had sent candidates. The examiners, in their report to the committee, speak very highly of the work done. Dulwich College had been most successful, securing both the gold medals, the gold medalist in physical geography having last year obtained the same position in political geography. Liverpool College was again successful, and the London International College had carried off a prize, and the City London School had obtained a creditable position.

Commander Cameron introduced the medalist in physical geography, and Admiral Sir Erasmus Ommanney, those in political geography.

The President, in presenting the medals, said with regard to Dulwich College, which had carried off both the gold medals, he would by permission of the meeting, make one or two observations regarding that institution. Having had the honor two years ago of presenting the prizes to the boys of Dulwich College, and thus becoming acquainted with the head-master, Dr. Carver had written a letter to him containing some remarks on the study of geography in schools which he thought would be of interest to the meeting. He inclosed a copy of the school list, and at the same time said: "You will see from these lists that Bowie, the gold medalist in physical geography, obtained the prize of his form in 'Form Work,' and was bracketed for the prize in 'Greek and Higher Classics' with Naylor, the gold medalist in political geography. Your Lordships will, I am sure, regard these facts as not altogether immaterial. They show at any rate that the proficiency of these boys in geography has not been attained by any special 'cramming' or by the sacrifice of their general culture to one conspicuous but passing success. To me the success of the College in the competition of the Royal Geographical Society has been gratifying, and just for this reason, because it has been obtained, not by boys making modern subjects their specialty, but by boys who were prepared to bring well trained and cultivated minds to bear upon any subject to which their attention might be directed."

To David Bowie, the gold medalist in physical geography, the President said: "I have great satisfaction in handing you this medal. A strong proof how

well it is deserved is furnished by your having gained, as Mr. Freshfield has told us, last year the gold medal in the other branch of the science, political geography, and were honorably mentioned in the examination of the year previous."

To the silver medalist, A. L. Humphries, the President said: "This is the fifteenth medal gained by the school to which you belong, Liverpool College, a striking testimony to the skill and success with which geography is studied in that institution, and to the pains taken by its eminent head-master, the Rev. George Butler."

Mr. R. N. Cust, at the invitation of the President, announced the special subject of next year's examination as being "Polynesia, including New Zealand."

ARGENTINE REPUBLIC.—An importation of 101 African ostriches has succeeded at Buenos Ayres. Their owner is an Englishman, who proposes to establish a farm for ostriches in that province; the climacteric conditions, according to his opinion, favoring his project.

EXPEDITIONS.—Dr. E. Pieroth, an Italian traveller and *savant*, is now organizing an Exploring Expedition to Egypt, Palestine and neighboring countries. He intends to leave Marseilles, on the second of September, and hopes to return by November first.

CAPTAIN BOVE, of the royal Italian navy, who was associated with Prof. Nordenskjold, in his late excursion to the glacial seas of the North, has projected an Antarctic Expedition He will leave next May and be absent two years among the glaciers of the South Pole His crew and steamer will be furnished by the Italian Government, from the royal navy—at an expense of about 600,000 francs.

NECROLOGICAL.—By sad concidence geology has lost two *savants*, W. H. Willer and M. Ansted, both having died on the same day. The former was eighty years of age and author of several classic works, of which, a treatise on crystallography was the most notable. Mr. Ansted was only sixty-six years of age, and was professor of geology at King's College, London, and Examiner on geography and physics, in the department of science and art. He was an author of numerous works. Both of these individuals were educated at Cambridge and belonged to the Royal Society.

FATHER HORNER, the celebrated Catholic Missionary, is dead. He had been a resident missionary on the island of Zanzibar for many years, and was conspicuous for his labors in behalf of the suppression of the slave trade, for his African travels, and for the sympathy and assistance he was always ready to give to explorers and scientists on the Eastern African coast. He died last May, at Cannes, France.—*L'Exploration.*

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A VIEW OF ÆTNA.

BY S. P. LANGLEY.

It was now December, but in spite of my haste to get on the mountain before the snows covered it, I stopped at Taormina, half-way to Catania (whence the ascent was to be made), to view Ætna from the north. Taormina is built on the southern slope of a spur projecting into the Mediterranean, whose northern ridge, rising a thousand feet above the sea, is crowned by the ruins of a Grecian theatre. The stream of pleasure-travel seems to pass by this wonderful coast, so that comparatively few tourists see the shores of Sicily, except from the steamer which takes them to Athens or Alexandria; but if the reader is among those few, he may remember the view from these ruins at sunrise as one of which the earth cannot furnish many. He will remember, perhaps, rising long before daybreak for a solitary climb through steep lanes, half seeing, half groping, his way between high walls, over which started into dim sight spectral figures with outstretched arms, resolved, as he drew nearer, into some overleaning cactus, vaguely outlined overhead against the starry sky. Mounting higher, one comes out from between the overshadowing walls into the moonlight, the waning moon, a crescent in the east, "holding the old moon in her arms," while, when higher yet, the columns of the ancient proscenium stand out against a faint glow that shows where the sun is yet to rise; till, passing by these, climbing and groping up the stone benches which once held tiers of spectators, one takes a solitary seat at the summit. Below, the last lights are still twinkling on the coast, but beyond and over the columns, all along the south, rises a dark something, which might be a hundred yards away, but is Ætna, and twenty miles distant. As the dawn grows brighter the outlook extends north and east to Italy, and as the sun makes ready to come out of the ocean the gray mass in the south moves further away, and takes on distinctness as it recedes, until we make out the whole form of Ætna, with the outline of the crater and of the snow fields about its summit. These distant snows suddenly changed their gray to a rose pink as they caught the light of the sun before it had risen to me; but of all that was seen when it came out of the ocean I was most concerned with the mountain itself, which can be viewed better here, as a whole, than from any nearer point.

The coast line on the left preserves the level to the eye, but except for this, so wide is the base of Ætna that it fills the whole southern landscape, which seems to be tilted upward till its horizon ends in the sky. I could see from here how almost incomparably larger the immense volcano appears than Vesuvius; and the actual difference is in fact enormous, the height of Ætna being (if we disregard the terminal cone of each) nearly three times, and its mass probably twenty times, that of its Italian neighbor. The entire mountain in all its substance is lava, which has built itself up in eruptions; but from this point the successive zones of vegetation are visible which in the course of ages have in part occupied its sur-

face. Extending to perhaps a fifth of the whole actual height before me (but covering a great deal more of the foreground in appearance), is the cultivated region. dotted with villages, which shine out from a background of what we know must be vineyards and olives. The second zone is barren, and in sharp contrast with the former. It rises to perhaps two-thirds of the whole height, and its broad masses of gray are patched with moss-like spots hardly distinguishable in color, but which are really forests of oak and chestnut. All above this rose what even from my distant station could be recognized as naked black deserts, streaked here and there with snow, while above this was the terminal cone, snow-covered at the time I saw it, and with a depression at the summit from which slowly drifted a thin vapor. The railway south of Taormina runs along the coast (and is carried through cuttings on old lava streams, which here flowed down to the sea) until it reaches Catania, a city which, as every one knows, is not only built on lava, but which has been cut through and through by lava streams, and shaken down by earthquakes in recent times, and which lives from day to day at the mercy of its terrible neighbor.—*July Atlantic.*

ARCHÆOLOGY.

A POMPEIAN HOUSE.

"The house which was begun to be excavated at the celebration of the centenary of Pompeii, and is, therefore called 'Caso del Centenario,' and from which I then saw three skeletons dug out, has proved to be the largest hitherto discovered, and is of peculiar interest. It contains two atria, two trielmia, four alæe or wings, a calidarium, frigidarium, and tepidarium. It occupies the entire space between three streets, and most likely a fourth, which has yet to be excavated. The vestibule is elegantly decorated, and its mosaic pavement ornamented with the figure of a dolphin pursued by a sea horse. In the first atrium, the walls of which are adorned with small theatrical scenes, the pavement is sunk and broken, as if by an earthquake, and there is a large hole through which one sees the cellar. The second atrium is very spacious with a handsome perisytle, the columns —white and red stucco—being twenty-six in number. In the center is a large marble basin, within the edge of which runs a narrow step. On the pedestal at one side was found the statuette of the Faun which we lately described. The most interesting place in the house is an inner court or room, on one side of which is the niche, with tiny marble steps, often to be seen in Pompeian houses. The fiescoes on the walls are very beautiful. Close to the floor runs a wreath of leaves about a quarter of a yard wide, with alternately a lizard and a stork. Above it, about a yard distant, droop, as if from over a wall, large branches of vine or ivy

and broad leaves like those of the tiger-lily—all freely, naturally and gracefully drawn. At each corner of the room a bird clings to one of these branches. Then comes a space—bordered at the top by another row of leaves—in which is represented a whole aquarium, as if the room were lined with tanks. There are different sorts of shells and aquatic plants lying at the bottom of the water, and swimming in or on it all kinds of fish, jelly-fish, ducks and swans, admirably sketched with a light yet firm touch. The ripples made by the swimming ducks are indicated, and one duck is just flying into the water with a splash. On each side of the niche this amusing aquarium is enlivened by a special incident. To the left a large octopus has caught a monstrous murænal (lamprey)—which turns around to bite—in its tentacles; to the right fine lobster has pierced another murænal through and through with its long hard feelers or horns. These creatures are painted in the natural colors very truthfully. On the left wall above the fishes, are two sphinxes, supporting on their heads square marble vases, on the brim of each of which sits a dove. Behind the niche, and on the left side of the room, runs a little gallery with a corridor underneath, lighted by small square holes in the border of hanging branches. The wall of this gallery behind the niche is decorated with a woodland landscape, in which, on one side, is represented a bull running frantically away with a lion clinging to his haunches; on the other, a horse lying struggling on his back, attacked by a leopard; all nearly the size of life. On each side of the doorway is painted respectively, a graceful doe and a bear. The other rooms are also very beautiful; one with a splendidly elegant design on a black ground; in another a small frescoe representing a man pouring wine out of an amphora into a large vessel. The bathrooms are large and elegant, the cold bath spacious and of marble. In one room a corner is dedicoted to the *lares* and *penates*, and in the fresco decoration, among the usual serpents, etc., I noticed the singular figure of a Bacchus or bacchante, entirely clothed with large grapes. In one of the mosaic pavements is a head of Medusa, the colors very bright and well preserved. As some of the ruins are only excavated to within two or three feet of the floor, it is possible that many valuable ornaments or statuettes may yet be found, as everything indicates that this splendid house belonged to some rich citizen."—*London News*.

INTERESTING DISCOVERIES IN CLINTON COUNTY, OHIO.

Ever since archæologists began the study of the origin, habits, mode of living and cause of the mysteriously complete disappearance of that strange race of people which we moderns call "Mound Builders," the absence of any pictured or written record from their hands has proved the rock in the way which stopped all further inquiry, almost at the entrance door to their charmed history. Thoroughly scientific and able men have studied the subject carefully and closely from the basis of the discoveries made of earthworks, utensils, weapons and or-

naments, and after years of patient work have published their theory of the matter to the world. Other men, with as great learning and ability, have followed in their footsteps and evolved other and contrary conclusions from the investigation of similar facts; they, in turn, to be followed, year after year, by still others with constantly varying opinions, until the manifold theories put forth in regard to the "entrance" and the "exit" of this extinct race have become a maze which leads in every direction, but centers upon no one point. All these theorists, however, are agreed that were any written characters or hieroglyphics of the Mound Builders to be discovered it would contribute in a marvelous degree toward the clearing up of the mystery. Short's "North Americans of Antiquity," a work published as late as the present year, says: "No well authenticated Mound Builder hieroglyphics have yet come to light." Clinton county is rich in remains of the Mound Builders, and our archæologists believe that they will yet supply the hiatus necessary to establish the identity and trace the race origin of the early rulers of America. More than a year ago Mr. Jonathan Richardson discovered in a mound in this county an engraved tablet-stone and a "butterfly relic" bearing hieroglypics, both of which were first noticed and described in the Cincinnati *Commercial.* They were afterward photo-lithographed and description and engravings issued in pamphlet form.

Now comes another discovery which is as important as any yet made. Mr. Jonah Frazier, a farmer, residing some four miles north of Wilmington, and in the vicinity of an old deer "lick," while spading in his garden on Friday evening last, unearthed a stone pipe of curious construction, which he yesterday brought in for inspection by your correspondent. The pipe is fashioned from the the stone known as Clinton rock, two or three specks of iron pyrites being visible, hard as flint and shaped like a rubber ball flattened by compression, its greatest diameter being 2¾ inches and its thickest 1⅜ inches. It is elaborately and artistically carved, being really a fine piece of workmanship. In a circular depression, filling the space of one of its sides, is a bas-relief (front view) of a human face with high cheek bones, wide, straight mouth, flat nose, full lips, low, broad forehead, and the entire facial features, indicative of the presence of craft, cunning and intelligence struggling for the mastery. It is not the face of an Indian, nor such a one as an Indian could have imagined. On the opposite side of the pipe is a hollow, fitted to the ball of the thumb when in position for holding the pipe. Through one side, and just above where the stem should be inserted, is drilled a hole, evidently intended for the reception of a string by means of which the pipe could be suspended around the neck of its owner, or upon the wall of his dwelling. On the front of the bowl—being the side farthest from the smoker when the pipe is in use—is an oblong sunken space in which is carved the outline of a beaver, its head toward the upper part of the bowl. But the main point of interest in this relic, and that which gives it its greatest value, consists in a series of hieroglyphics beginning just below the face and extending around the under side of the bowl. A quarter of an inch below the circle which

incloses the face is a character fashioned like the figure 8 laid upon its side, with the two inclosed spaces filled with curious characters, and its right end adorned with a cresent shaped mark with the horns turned outward. Beneath this are other characters in some respects bearing resemblance to those of the Maya language. One is shaped like a wheel with four spokes; another like the letter G, with three dots inclosed, and a branch with twigs, shooting from its upper side, while others take on shapes the like of which we have never seen before.

May not these little figures prove to be the lever that shall unravel the mystery which surrounds the history of that race whose footprints on this continent are so strongly outlined and yet so inexplicable, and set at rest the floating theories in regard to their origin which have been so contradictory and unsatisfactory? Mr. F. has been offered a considerable sum of money for his "relic," but refuses to sell. It is now temporarily in the possession of Dr. L. B. Welch, of Wilmington, a well known experienced archæologist.*

* Referring to this discovery we call attention to the following note by a well known writer who sends us the article.—[Ed.

THE ANTIQUE PIPE FOUND IN CLINTON COUNTY.

To the Editor of the Review:

I notice an account in the Commercial of a pipe recently found in Clinton County, and compare the figures you engrave as *fac similes* of those on the pipe with those in the third and fourth volumes of Lord Kingsborough's "Antiquities of Mexico." Is there any good reason why the theory may not be sustained that all the specimens of sculpture so numerous in the Mississippi Valleys may not have been the product of the people inhabiting Mexico at the time of the conquest of that country by Cortez? The Indians made none of them, but received them all in the way of trade from the far more cultivated race of Mexicans. The specimens of pottery found on the banks of the Ohio are all of a nature similar to those found in Kingsborough's great work, and were received by the Indians. That many of them were deposited in mounds was, of course, natural, as they are also found all over Eorope in similar mounds, constructed by the Scythians and other barbarous people. See Martin's History of France and Thierry. Similar specimens of sculpture are also found now in the Canary Islands. Why do not the facts properly suggest that the artists belonged in all cases to the same race, and that this race found its way to the American Continent, by way of the Canary Islands and the East Atlantic Islands that once stood where now is found the Sargosso Sea? That portion of the race that had reached Mexico before the sinking of the lost Atlantis became isolated from Europe and was in the plenitude of its civilization when Cortez discovered it and ended its career by conquest. This race naturally spread all over the American continent, taking full possession of South America, where Peru was the center of power. In advancing to the North it met the Indians, who had come from the north of Europe by way of Greenland

and from Asia by way of Behring Straits. The Indians remained masters of the North, while the Mexicans perfected their civilization in the South. Had Cortez worked as hard to discover history as he did to plunder the people of Montezuma, he was in a condition to have had his labor rewarded with some of the most astounding developments of all antiquity. But the old scoundrel b rned, destroyed, exterminated every link he found, as far as possible, and we now have a few relics with nothing but guess work as to their meaning. Everything found now should be preserved with "religious" care, until the key to the meaning of hieroglyphical characters is at last found, and the mystery of the Aztecs and the Indian race cleared up.

ANTIQUITAS.

THE ORIGINAL SETTLERS OF AMERICA.

A deep interest is taken in the explorations about to be made in Mexico and Central America, in order to bring to light the lost history, skill, inventions, arts, genius and science of the unknown races who lived, died and passed into oblivion on this continent. Many remains have been discovered, but much still remains to reward the antiquarian, the historian, and the friend of humanity.

One link needs perfecting. The Aztec antiquities now on exhibition in the Metropolitan Museum of art are nearly similar in design to those discovered recently in the Isle of Cyprus. It may possibly be shown by further discoveries that the same race of men who inhabited Cyprus struck America 1400 or 1500 years before the Christian era. This discovery will show that the Phœnicians, Carthaginians, or Egyptians colonized America.

America is an old country. It is an error to say it was discovered by Columbus. That was only a restoration of the knowledge lost by a certain portion of the world, through timidity, fear, and a want of skill in navigation. What had been known to millions was no discovery. People talk of the discovery of glass and the circulation of the blood as something new. The Phœnicans and Plato knew of them thousands of years ago. There is a strong probability that America was partly colonized by the Phœnicans, Carthaginians, and Egyptians.

In the elaborate article in the SUN on this subject you are right in speaking of American civilization as dating back to the beginning of Assyrian history. If it can be shown that American antiquities are similar to those of the Phœnicians and Carthaginians, then the race of Cham and not of Sem originally peopled America. The same race colonized Spain, Ireland, France, Italy, Sardinia, Sicily, and the Balearic Isles in the Mediterranean.

In calculating the increase of population after the deluge, we may recall the fact that seventy souls among the Jews went down to Egypt; in the course of 215 years they numbered nearly 3,000,000. Still further, the Phœnicians having planted small colonies in various countries, these grew into nations.—*Cor. N. Y. Sun.*

FOREIGN CORRESPONDENCE.

SCIENCE LETTER FROM PARIS.

June 18, 1880.

French alienists consider "hallucination" as a perception without an object, and "illusion" as a real perception falsely interpreted. In both cases the result is due to united physical and mental causes, that is, the commencement is a physical sensation. An ancient and famous philosopher maintained that the entire universe was only a gigantic hallucination. People are not necessarily ill or mad because laboring under an illusion; at a distance a square tower may appear round, owing to perspective modifying the apparent forms of objects. In the eyes of a maniac, linen suspended from a line becomes hanging corpses; images floating in the air, appear balloons directed by aeronauts. Laseque defined, that illusion is to hallucination, what slander is to calumny. With lunatics at least, it is the ear which occupies the first rôle in cerebral troubles; they hear the sound of footsteps as of a person walking in another room; or some musical notes, musketry fire, or the reports of cannons. But there is an abyss between the patient who hears only sounds, and him who listens to words, the latter at first in monosyllables, then becoming phrases, and finally sentences, till the afflicted indulges in replies, and terminates by believing he is in presence of a distinct personality who encroaches on his existence. Such is the meaning of the "possessed" of the Middle Ages, and later of the seventeenth century. It is thus that the exorcists charged to deliver the Ursulines of London from the diabolical spirits of which they were possessed, became in several instances themselves the victims of the epidemic. Sight also plays a conspicuous rôle in hallucinations, producing alcoholic night-mares, and unceasing terrifying visions. The sensitive apparatus is composed of extremities which receive the impression; the tube which transmits it, the ganglions which receive and condense it, then those cellules of the hemisphere of the brain which perceive it, and that represent matter in its highest expression of relationship with intellectual fuctions—and where alone phenomena can be judged. The deaf, strange to say, suffer from hallucinations of hearing, as well as the blind from those of seeing. Certain physiologists maintain, that we ought never to forget anything, because the cerebal cells always remain filled with impressions, though in a latent state, and that there is a mystical power, independent of our will, at work, ready to call up these forgotten sentences. During a conversation, we may suddenly forget a name or date; next day when the circumstance has passed away, the wanted name or date will surge up. What is that automatic, mysterious secretary that has been working for us independent of our will? J. J. Rousseau, when conversing, was heavy and embarrassed, and it was only on arriving at the foot of the staircase that he discovered the witty reply that he ought to have made in the draw-

ing room. Often when at school, the lesson imperfectly learned during the evening, becomes well engraved in the memory on our awakening. The mind has worked for us during sleep, but we were unconscious of its acts. In antiquity, visionaries saw appear the black Eumenides or the divine Apollo; mythology is now replaced by the Virgin and the saints, and it is a fact well known to alienists, that the delirium and hallucinations of Catholics differ essentially from those of Protestants. Van der Kalk remarks, that it is by the left ear that patients who are possessed, assert they hear Satan speaking to them, while another patient claiming to be in relations without a good and bad spirit, at once invariably received whispers of vice by the left, and counsels of virtue by the right, ear.

The sun has become a subject of very popular study; naturally we ought to be interested in the rays of a star on which life hangs. The sun is the heart of the planetary organism: each of its pulsations spreads vital force not only to our earth, some thirty-seven millions of leagues distant, but to Neptune 1,100 millions of leagues away, also to the pale comets abandoned to an eternal winter, and still farther, to stars millions of milliards more distant still. This force emanates incessantly from the sun's energy, and is distributed around into space with marvellous rapidity; eight minutes suffice for light to bound to us from the sun, at the rate of 75,000 leagues per second. The sun is 108 times larger in diameter than our earth; 1,279,000 times more voluminous, and 324,000 times more dense. The highest dome in the world is that at Florence erected by the genius of Brunelleschi; it is about forty-nine yards in diameter, the dome of the Pantheon of Paris is but twenty-three yards, yet the latter and a bullet eight inches in diameter, would represent the relative magnitudes of the sun and our planet. In other words, suppose the sun placed in a scales, it would require 324,000 earths to make the scales turn. The planets that revolve 'round the sun resemble so many toys, yet sun and stars themselves are only atoms of the infinite. The moon gravitates around the earth, and the earth around the sun, while the sun whirls the planets and their satellites toward the constellation Hercules, and these movements are executed with a rythm and exactitude, following determined laws, as the hands of a watch turn on the pivot or the concentric circles that ebb away on the surface of a pond when a stone is thrown therein. All is movement, vibration, harmony. In violet light the atoms of ether oscillate at the rate of 740 milliards of vibrations per second; red light is slower, its vibrations in the same time are about 380 milliards; the color violet, is in the order of colors, what the highest note is in the order of sound; red represents the lowest color, or base note. An object floating on the water obeys the ripples or waves which arrive from various sides, so the atom of ether undulates under the influence of heat and light, the atom of air under the influence of sound, and the planet and the satellite under the influence of gravitation. To comprehend the distance of the Earth from the Sun, were a cannon ball to travel at the rate of 550 yards a second, it would require nine years and eight months to reach the sun. Again the Sun is the center of most astounding conflagrations and explosions. If the space between our planet and the Sun

could transmit the noise at the usual rapidity of 374 yards per second, the sound would necessitate some fourteen years to arrive to us. A train traveling at the rate of thirty-eight miles an hour, would require 266 years to reach the Sun. A vogager who left at that rate of traveling during the reign of James I., would only be due at his destination to-day.

The Sun is the source from which flows all the forces that put the earth and its life in motion, it is the Sun's heat which causes the wind to blow, the clouds to rise, rivers to flow, forests to grow, fruit to ripen, and man himself to exist. This united force, constantly and silently, exercised to raise the resevoirs of rain to their mean atmospheric height, to fix carbon in plants, to give to terrestrial nature her vigor and her beauty, is estimated in a mechanical point of view, to be equal to 543 milliards of steam engines, of 400-horse power each, working day and night incessantly. It is the Sun's heat which maintains matter in its three states, solid, liquid and gaseous. Examined through a powerful instrument, the surface of the sun appears to be covered with small grains of different forms, but where the oval predominates, the interstices which are very free, form a kind of gray net-work, the knots of this net-work enlarge sometimes as to form pores, which increasing still, give birth to a "spot." The luminous surface of the Sun has been called *photosphere*; it is not uniform but composed of a multitude of luminous points, disseminated on the somber net-work. These points or grains, produce the heat and light that we receive from the Sun, and occupy about one-fifth part of the surface of that star; if they approach closer to each other, multiplying and condensing, the dark netting would disappear, the light would be increased from two to five fold, and the heat in proportion; were they on the contrary to diminish, light and heat would disappear, and the world expire from cold. We call flame and fire all that which burns, but the gases in the Sun's atmosphere possess such an elevated degree of temperature that it is impossible for them to burn. Occasionally protuberances are visible round the sun; these are due to explosions of hydrogen, which shoot that gas upward at the rate of 244,000 yards in a second; these eruptions continue during several hours, often days, motionless as immense luminous clouds, when they fall down in showers of liquid fire. These phenomena are hurricanes; now a hurricane of the greatest intensity on our planet, does not travel at a greater rate than 100 miles an *hour*, the fire-hurricane travels that space in a *second* Vesuvius has entombed Pompeii and Herculaneum beneath its lavas. A solar eruption shooting up flames to the height of 63,000 miles in a few seconds, would bury our earth under its shower of fire, reducing terrestrial life to ashes in a shorter space of time than is required to read these lines.

Messrs. Richet and Mourrut have conducted a series of experiments at Havre on digestion with fishes; with the latter, as in the case of other classes of vertebrata, there is a very great diversity in point of intensity of digestion; pending the process of digestion, the stomach is very acid, and the contrary when the stomach is empty; the gastric liquid acts more powerfully the less it is pure; temperature

augments the digestive process, and while the gastric juices do not at all affect starch, they rapidly transform fibrine.

Messrs. de Fonvielle and Lontin have produced a new and elegant form of electro-magnetic rotation, very ingenious, and that will be an addition to lessons in physics. The apparatus consists of a galvano-metric frame, in the center is a piece of iron on a pivot, which is polarised by a magnet, fixed on the exterior of the frame. When the electric current traverses the galvano-metric spirals, the piece of iron revolves with a grand rapidity. The principle is not novel and depends on the difference in intensity of the alternative currents. The latter if produced by a Gramme machine, and made intermittent, will serve equally well.

M. Lichtenstein has placed the insects, which produce the gall nut, in some tubes, in time they deposited young insects, which perished, as he did not know their peculiar food. He observed that during August other insects replaced those that had left the gall nut, and produced young, the latter disappearing in the tender twigs of the (poplar) tree, forming thereon a kind of pad.

Asparagus, the variety white stems and purple heads, is a favorite spring dish in France, and the Italians in their love for that comestible are surpassed by the French. The market gardens of Argenteuil eclipse those of Ravenna. Does asparagus exercise a nutritive action? It is doubtful; it contains a little phosphate of lime and potash. However, it is a very light and agreeable aliment, admirable for convalescents, on condition that the sauce suits their stomach. Asparagus excites the appetite and has a diuretic action. The root of the plant is employed against jaundice and affections of the bladder, it relieves, according to some hypertrophy of the heart. It is employed as a calmant by others, as it does not irritate the stomach, like digitalis; it is bad for those recovering from articulated rheumatism; there are authorities who profess asparagus will cure hydrophobia. As a curative agent it may be safely concluded to have no effect.

Dr. Delpech demands that rearing bees on the outskirts of the city be prohibited. Several fatal cases of stinging have occured, especially in the face, the neighborhood of the nervous centers, where the blood, changed by the venom of the sting, rapidly decreases the activity of the nervous system, thus suspending the functions essential to the maintenance of life.

In the Cevennes, sheep are largely reared for their milk, which is made into cheese, the Roquefort being the most celebrated; even in the time of Pliny the sheep cheese of Lozère (Luzara) was famous, and was sent from Nismes to Rome. Two curious facts to note in connection with this breed of sheep, reared for milking purposes; many have four nipples, cases occurring of yielding milk by each, and the ordinary two teats are very voluminous.

M. Toussaint has studied the subject of phthisis in pigs, and finds that it is hereditary, and can be contracted by the progeny while sucking, by inocculation or co-habitation. The disease resembles galloping consumption in human beings, and brings about death in a few weeks. In sheep the malady takes a chronic form.

BOOK NOTICES.

LIPPINCOTT'S PRONOUNCING GAZETTEER OF THE WORLD: pp. 2478 large Octavo: J. B. Lippincott & Co., Philadelphia 1880. For sale by H. H. Shepard. $10.00.

It is difficult adequately to conceive of the vast strides made in geographical knowledge within a few years, except by comparison of old works with new ones, and this will be found an especially truthful statement by the student who compares any Gazetteer more than five years old with that recently published by J. B. Lippincott & Co. He will find that it now takes nearly 2500 pages, double column, fine print, to describe what was fully described a few years since in far less space. He will also be surprised to learn not only that many new and important places have sprung into existence and become important commercial centers, but that so many which were in former editions mentioned as thriving cities and towns, even in our own country are now utterly abandoned and unknown. It is astonishing to see how perfectly the work under consideration has been made up. It not only contains recent and authentic information respecting the countries, islands, rivers, mountains, cities, towns, &c., in all portions of the globe, but it actually gives an account of more than one hundred and twenty-five thousand places, with correct spelling and pronunciation indicated in all instances. We have been surprised and have quite surprised several friends, by the extreme minuteness of the information contained in this work as well as by its extent. Of course, to secure such perfection a vast amount of labor has been expended in consulting similar works in all languages, books of history and travel, official documents, and by a most extensive private correspondence all over the globe.

In addition to the vastly increased number of places noticed, such particular attention has been paid to orthography, pronounciation, ancient and modern names of places and signification of geographical names as to render them characteristics of the work.

For public libraries, schools, teachers, and all persons requiring books of reference, this is a book of sterling value and of the most reliable character.

FIRST ANNUAL REPORT OF THE DEPARTMENT OF STATISTICS AND GEOLOGY OF THE STATE OF INDIANA. 1879, pp. 514, Octavo: Indianapolis, Douglass & Carlin, 1880.

It is a little singular that at this late day the State of Indiana is publishing her first Report of this kind. With her exhaustless resources of almost every kind it would naturally be supposed that they would have been long years since made known to the world in every practicable way.

But though late in beginning, the work has been well done, and no one can

read this Report without acknowledging that the facts compiled have been judiciously and forcibly set forth and that great credit is due Professor Collet and his assistants for industry in collecting and skill in preparing them. The general description of the State with which the volume commences, and the statistical tables which follow, furnish the most complete and satisfactory account of the progress of the State in agriculture, manufactures, trade, finances, education, religion, population and hygiene that could be desired and just such information as the immigrant needs.

PROCEEDINGS OF THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA, FOR MARCH, APRIL AND MAY, 1880: pp. 152 Octavo, illustrated.

This Society, which has been in existence since 1817, still keeps up its active work and this volume contains the results of the original researches and investigations of some of the best known naturalists in the country; such as Leidy, Meehan, Lockington, Heilprin, Kingsley, Allen, Bergh, Redfield and Kelly, and is illustrated copiously.

Dr. Ruschenberger is President, Prof. Thomas Meehan, Vice President, and Prof. Jos. Leidy, M. D., is Chairman of the Publication Committee and Edward J. Nolan, M. D., Editor.

ENGINEERING PROGRESS IN THE UNITED STATES: By Octave Chanute, C. E: pp. 40, Octavo.

This is the annual address for 1880, read by Vice-President Chanute (formerly our fellow citizen) at the twelfth Annual Convention of the American Society of Civil Engineers, held at St. Louis, May 25th, 1880

The paper is a condensed and at the same time comprehensive review of engineering and engineering inventions in this country; taking up consecutively the principal points of interest in connection with Water Works, Hydraulics, Canals, Street Railways, Bridges, Preservation of Timber, River Improvements, Light Houses, Marine Engineering, Telegraphic Engineering, Gas Engineering, Metallurgy and Mining, Agricultural Engineering, Transportation of meats and the Engineering Future.

It is concisely written, but possesses great interest, and will doubtless furnish to future numbers of the *Review* some valuable chapters.

THE STUDY OF LANGUAGES Brought back to its True Principles: By C. Marcel, pp. 27, Quarto: J. Fitzgerald & Co., N. Y. For sale by the K. C. Book & News Co.; 15 cents.

This is number eight of the Humboldt Library, and like its predecessors is a shining example of a good thing in cheap literature. M. Marcel is the author of "Languages as a Means of Mental Culture" etc., and has had large experience as a teacher. This work is a brief summary of a larger work not yet published, but in it are given special directions for the acquisition of ancient and modern lan-

guages by learners of all classes. It is divided into chapters upon Subdivision and order of study, The Art of Reading, The Art of Hearing, The Art of Speaking, The Art of Writing, Mental Culture and Routine, and covers the ground fully in each instance.

OTHER PUBLICATIONS RECEIVED.

A Record of the Progress of Astronomy during the year 1879, by J. L. E. Dreyer, M. A., of the Observatory of Trinity College, Dublin, Ireland; 47 pp. Octavo:—No II. and III. of the Publications of the Missouri Historical Society of St. Louis, being the Recollections of a Septuagenarian, by Wm. Waldo Esq., 22 pp. Octavo:—The Eleventh Annual Report of the American Museum of National History, Central Park, N. Y. : 33 pp. Octavo:—Annual Report of the Board of Directors of the Chicago Astronomical Society and Dearborn Observatory, 1880 (illustrated) 16 pp. Octavo:—Circular of the Horological and Thermometrical Bureaus of the Winchester Observatory of Yale College, New Haven, June 1880, 8 pp. Octavo.

SCIENTIFIC MISCELLANY.

DOCTOR TANNER'S FAST.

At noon on June 28th, Dr. S. H. Tanner, of Minneapolis, Minn., commenced at Clarendon Hall, New York City, an attempt to abstain from all food for a period of forty days. It appears that there had been some controversy between Dr. Tanner and Professor W. A. Hammond and other members of the New York Neurological Society, upon the subject of the length of time that the human system could endure total abstinence from food, and that the Professor had made Dr. Tanner an offer of one thousand dollars if he succeeded in living without food for forty days. This proposition, in consequence of a mutual misunderstanding, was subsequently withdrawn and the Doctor has been conducting the experiment at his own cost and risk.

Dr. Tanner is about forty-nine years of age, weighed at the commencement of his fast, 157½ pounds, and is of a rather nervous temperament. He has been vigilantly watched at all times, but especially so since the ninth day, when a detail of members of the Neurological Society was made for the purpose.

For the first few days, owing to the newspapers being filled with exciting political news, the dispatches were very meager, but as the time has progressed, and the termination of the experiment has approached, the public interest in the case has been very marked and is daily growing in intensity. At the end of the

fifth day he had lost in weight about ten pounds, or an average of two pounds a day.

On the seventh day his temperature was 98½° Fahr., and his pulse 96, soft and compressible. The skin was moist and healthy, the countenance pleasant, and without the usual appearance of anxiety that follows long fasting, and the eye clear and unwavering, with normal dilatation of the pupil. The tongue was moist and slightly furred, but not more so than would naturally follow twenty-four hours' privation of food. His conversation was deliberate and coherent, but a little languid. The dimunition in the excretion of urea was surprising, as determined daily by Dr. Van Der Weyde.

On the ninth day his temperature was 98$\frac{3}{10}$° and his pulse 96. On the 10th day some interesting experiments were made by his watchers about 9 o'clock to determine whether or not his sensibility was diminished. The æsthesiometer was employed, an instrument consisting of two sharp points which are arranged at right angles to a graduated scale, upon which they can be moved backward and forward. This was applied to Dr. Tanner's feet, legs, hands and arms. He was almost invariably able to tell whether one point or two had been applied, even when they were very near together. He distinguished distance as small as three-eighths of an inch, and the opinion of the physicians was that his sensibility was not diminished.

On the eleventh day he succeeded in regaining some of his lost sleep, and his face looked a little less pinched and haggard, and his voice was clearer and stronger. At noon Dr. Harwood made a careful examination. The tongue was found slightly coated; pulse 88; temperature, 98$\frac{3}{5}$°; respirations, 14. The weight as taken that day was 139¾ pounds, showing a loss of about seventeen pounds. His legs and arms appeared comparatively plump and full. About eight o'clock Dr. Gunn tested his strength and sensibility with the dynamometer and æsthesiometer and detected nothing abnormal.

Dr. Maurice N. Miller, of the University Medical School, watched Dr. Tanner during three days as a scientific observer. He made a number of analyses in the college laboratory which convinced him that Dr. Tanner had taken no food. After carefully ascertaining the amount of urea in Dr. Tanner's bodily fluids, he pronounced him to be really fasting. On the 13th day he said: "To-day has tended to increase my conviction that the Doctor can not last another week. To me he seems unquestionably more feeble to-day than yesterday. His temperature is very high and the back of his neck and head is exceedingly hot and feverish. This indicates an excessive amount of nervous wear and tear, which, of course, results in exhaustion of the nervous system."

On the thirteenth day his temperature was 97¾° and his pulse 90 at 8 a. m. At 6 p. m. his pulse was 96, temperature 98$\frac{8}{10}$°, respiration 14. By the dynamometer test it was shown that he had not yet lost any muscular strength.

On the fifteenth day the temperature was 98°, respiration 15, pulse 107, weight 133 pounds. Much of his time is spent in dozing and rinsing his mouth with

water, which he ejects at once. He complained of cold and seemed drowsy and sluggish.

Entering on the eighteenth day of the fast, Dr. Tanner exhibited a marked improvement. From nine o'clock last night until noon the Doctor swallowed between thirty and forty ounces of water. His weight this morning was 137½ pounds. Allowing one pound for the weight of the coat, he has gained four pounds since Wednesday. He took a drive to Central Park in the morning, and forced the dynamometer up to 151, against 80 yesterday. His pulse when last taken was 80, temperature 98⅖°, and respiration 16.

His condition was unchanged in the afternoon. He went out for a drive to-night. His pulse was 76 and temperature 98⅘°. He forced the indicator of the dynamometer up to 166 pounds, showing a slight increase in strength. During the past twenty-four hours he drank seventy ounces of water and felt better for it.

Dr. Chas. S. Tuttle stated that during the experiment up to the eighteenth day one of the attending doctors and himself had both made five chemical analyses, and both had failed to discover the least indication of any nourishment having been taken.

On the nineteenth day his pulse registered 82, respiration 16, temperature 98⅖°, weight increased to 136½ pounds, although he had taken but twenty-eight and one-half ounces of water in the twenty-four hours.

Dr. Tanner entered upon the twentieth day of his fasting in good condition, pulse recorded at 84, temperature 99°, and respiration 16; weight 135½ pounds, showing a loss of half-a-pound in the twenty-four hours, although he had taken twenty-two ounces of water.

On the twenty-first day his weight was 135 pounds, pulse 82, temperature 99½°, respiration 16, while the watching physicians agreed that his physical and mental condition indicated a decided improvement over that of a few days before and that he did not have the air of one whose vital forces had suffered much loss.

On the twenty-second day his weight was 134 pounds, pulse 72, temperature 99°, respiration 15.

On the twenty-fourth day, pulse 75, temperature 98°, weight 132, respiration 15. Manner bright and lively.

On the twenty-fifth day he complained of vertigo and nausea in the morning, but at noon was feeling better. Pulse 72, rather weak and more compressible, temperature 98¾°, respiration 16.

On the twenty-sixth day his watchers agreed that his appearance was worse than at any time before and his manner of walking was heavy and languid though he made a strong effort to appear vigorous. The pulse was found to be 80, temperature 98⅖°, respiration 16; weight 131½ pounds. He expressed the opinion that water was distressing him and declared his intention to drink less of it for the future.

On the twenty-seventh day his symptoms remained much the same; nausea and heartburn, with great thirst. His pulse was 76, temperature 98⅗° and weight 130½ pounds.

Dr. Miller said: "I form my ideas in regard to the Doctor more on my private chemical analysis than on anything else. I have found that for the last few days the waste of poisonous matter from the system has been steadily decreasing, hence this poison must be accumulating in the body and will inevitably lead to blood poisoning."

On the twenty-eighth day the evidences of nervous and muscular prostration were more apparent than on the day before and his stomach was too irritable to retain water. Pulse 74, temperature 98⅖°, respiration 16, weight 129¼ pounds.

On the twenty-ninth day all his symptoms were more favorable. Pulse 84, temperature 98 $\frac{8}{10}$°, respiration 14, weight 130 pounds.

On the thirtieth day everything favorable.

On the thirty-first day the symptoms were decidedly alarming and indicative of speedy collapse.

On the thirty-second day, however, there was some improvement. Pulse 72, temperature 98⅘°, respiration 15, weight 127.

The history of this case is very remarkable, for while other cases are upon record where the fasters are reported to have abstained from food as long as Dr. Tanner, and some even longer, this is perhaps the one in which the greatest pains have been taken by really scientific men to prevent imposition and to note all the conditions, at regular intervals. And it must be admitted that most of the symptoms in this case have been quite different from those expected and predicted by the skillful physicians in attendance, as well as those taught by our best physiological authors. The temperature of the body in particular, instead of being materially lowered, in accordance with medical teaching and experience, has remained nearly normal; while the pulse and nervous system, since the first ten days have been regular and healthful in action. The weight too has been far less reduced than any one could have expected.

Of course there is room for suspicion that food has been supplied in some unknown manner, but the probabilities in favor of this manner of solving the problem are very few indeed, and we must turn to some other source for an explanation of the facts.

THE HUDSON RIVER TUNNEL.

This is one of the greatest undertakings of modern engineering science. The tunnel has been carried a little more than 300 feet from the great well at the foot of Fifteenth street, Jersey City, or about 200 feet out under the river. The work of sinking the well on the New York side is soon to be begun near the foot of Morton street, whence the laborers will bore westward under the river and eastward to a point near Broadway, where the New York entrance will be. The rate of progress on the New Jersey side will soon be about eight feet a day, bu on the New York side, where they must penetrate about a thousand feet of rock, the progress must necessarily be slower. Operations are continuous, night and day, seven days a week, there being three sets of laborers, relieved every eight hours. Only one tunnel has been begun. There are to be two. Originally it was planned to bore one enormous tunnel, and on both sides of the river there

will be one tunnel down within 200 or 300 feet of the banks of the river. Thence under the river there will be two tunnels—one for trains into the city, and one for trains from the city. Each tunnel will be about twenty-two feet in height by twenty feet in width in the clear, and circular in form. The outer shell of the tunnels is boiler iron, breaking joints and firmly riveted together, and within this iron tube will be a two foot wall of hard burnt brick, laid in cement, and extending completely around the interior, presenting the form of an arch against any outside pressure, whether vertical or lateral. The track for railroad trains will lie about forty feet below the bed of the river, and near the New York side, where the depth of water is about sixty feet; the traveler in a car under the Hudson will be about 100 feet below the vessel overhead. The company's officers say that they can dispatch 400 trains through the tunnel every twenty-four hours. The engineers vary very widely in their estimates of the cost of the enterprise, some fancying that the $10,000,000 capital will complete the work, and others that it will cost as much as $17,000,000. The company expect to complete the work about three years hence.—*K. C. Times.*

PERIHELIA.

People will discuss the wonders of the universe, and just in proportion as the phenomena are mysterious will they see signs and believe in the occult influences of the stars. And just now the perihelion of the four great planets, Jupiter, Saturn, Neptune and Uranus, is a source of vague dread to millions of people. It is true they are approaching their nearest position to the sun, and what is to be in that regard has not happened in eighteen hundred years. But history furnishes nothing coincident with similar occurrences to cause any dread now, though we must conclude that the influence which must be exerted between sun and planets to keep them in their places and govern their movements, will be more intense in action when nearest together, than when separated by the tremendous distances of the outer boundaries of their orbits. Neptune, the most distant of all the planets from the sun, requires 164 years to complete its circuit, while Jupiter requires less than one-twelfth of that time.

But, then, similar stellar perihelia as to other planets have occurred, the last one of any note being in 1708, and following years. But this was not marked by any unusual phenomena, and there is no reason to suppose it will be so in the case of these four. The distances of Uranus and Neptune and in fact both the others are so great as to preclude the supposition that the influences from them will be any more marked than in like positions of inferior but nearer planets.

There is, in fact, nothing upon which to ground apprehension or to find cause for any baneful results from these planetary conjunctions, or that they even exercise a sway upon the meteorological conditions of our earth. Their perturbing force seems limited to a slight alteration of the elliptical orbit of the earth, and beyond this they do not appear to affect our little world, but, like all large bodies toward small ones, are complacent and kindly disposed.—*K. C. Journal.*

MINING AFFAIRS IN ARKANSAS.

The traveling correspondent of the New York *Mining Record* has been investigating mining affairs in Pima county, Arkansas, and arrived at the conclusion that mines there are well worth owning, both gold and silver being found in goodly quantity. Writing from Dos Cabesas, he says: I went on top of the main mountain that I believe is as full of gold as a mountain can well be, and it was no fool of a job. It was a mountain "as is a mountain," so steep that I left my mule at various points, and when I did attempt to ride him the same was of short duration, and it was harder to lead him than it was to do the walking. Prior to my ascension, I visited the Greenhorn, depth ten feet, with $70 gold assay; Bear Core, depth seventy feet, silver, $90 per ton; Ewell Springs, sixty feet, average, silver, $30 per ton; Jumper, eighty feet, silver, with remarkable assays. On the top of this mountain, I found lead after lead pointing to and reaching the top; they are well defined and wide. Blind Tom could almost see them. Float matter could be picked up almost anywhere near the summit. By my guide I was told to select a piece, and he would "horn spoon" it for me. I did, and did my level best to make the worst selection I possibly could; I took a piece of rock that looked bad in every particular; in fact, the average man would not think it worth while to turn it over anywhere in a gold region, but when it was crushed and "horned" out, I saw a different feature in the case. By applying an eye-glass to the same, I found gold staring me in the face beyond the question of a doubt. I look upon this mountain as one containing wealth in gold almost beyond computation. I do not give the opinion as an expert, but as one who has a pair of eyes in his head and sees in an unprejudiced manner. On both sides of the mountain, silver leads are thick and miners with plenty of "sand in their craw" are hard at work developing the same. On the other side of the mountain, and nearer to Tombstone, other miners are at work developing the many leads they have discovered.—*St. Louis Journal of Commerce.*

PIPE-ORE LIMONITES.

We can not pass without notice, the beautiful hypothesis offered by Professor Lesley (p. 17, QQ, Second Geological Survey of Pennsylvania) to explain the genesis of the "pipe-ore limonites." These are not to be confounded with the "pipe-veins" of Derbyshire, for instance, which are merely tubular bodies of lead ore occurring in fissure-veins. The "pipes" of limonite are "singular steeples of botryoidal and radiated iron ore," which "rise from the solid ore at the bottom of some of our great mines to heights of fifty and even 100 feet, through deposits of ore-bearing clays which fill vast pots in the limestone country."

Professor Lesley says he has long held that these deposits are made in caverns, the roofs of which were subsequently carried away by erosion. But there

was difficulty in accounting for the support of the vast roofs which the size of some of the deposits required. He now suggests that these roofs were supported by "stalagmite steeples, rising to meet stalactites pendent from above"—a phenomenon common in large limestone caves. "If such a cavern, with all its piers finished, were to have its outlet choked, and to be filled with water through which insensible currents moved, it would become filled with ferruginous clays, and in the end all its piers of calcite would be metasomatized into limonite of the variety known as pipe-ore." Subsequent erosion removing the roof would expose the clay as the country surface, and leave the metamorphosed stalagmites as pipes of ore standing in the clay and "descending with broadening bases to the floor." This explanation seems to us to fit the observed facts perfectly.—*Engineering and Mining Journal.*

With respect to the six days of creation corresponding to six geologic periods, let me repeat that no such six periods are known to geology. No geologist recognizes just six periods in creation. Lyell treats of four eras, thirteen formations and thirty-eight strata; Dana mentions seven ages of rock, five divisions, or ages, of geologic time (and very different, indeed, from the six days of Genesis), subdivided into twenty-three periods. Gray and Adams describe five classes, eight orders, and fourteen systems of rocks; Page's "Geology" has five classes and twelve systems; Steele's "Fourteen Weeks in Geology" has four eras or times, seven ages, and twenty-one periods; Figuier and Bristow have five epochs and thirteen periods; Denton has eight ages, or eras, and eleven periods; Taylor has three eras and nine periods; Dawson has four periods and sixteen minor periods; Gunning has ten great periods; Nicholson has three periods and thirteen systems or formations; and Newberry has four eras, seven ages, and twenty-two periods. Nowhere do we find a trace of any *six* geologic periods.—*W. E. Coleman in Western Homestead.*

RAG SUGAR.

It is said that a German manufactory produces, per day, five hundred kilogrammes of glucose, taken from old linen rags. These rags, composed of fibers of almost pure cellulose, are first carefully washed, then treated with sulphuric acid (oil of vitrol) which converts them into dextrine. The dextrine so obtained is submitted to a wash of lime water, then treated with a new quantity of sulphuric acid, stronger than the preceding. Next the mass is transformed and crystallized into glucose, chemically identical with that which constitutes natural sugar, called grape sugar, the same which is found in honey and ripe fruits. With this glucoe they make, in a manner as fraudulent as it is economical, rich confections, gooseberry jelly and others, according to the choice of the consumer.—*Le Technologiste.*

PRESERVATION OF FOODS BY SALICYLIC ACID.

TRANSLATED BY MISS MAY FEE FROM "LE TECHNOLOGISTE."

The author has had in particular view, in the following, the household exigencies during the summer season—the time when we see all kinds of meat and fish rapidly spoiling. Who can calculate the amount of meat spoiled during an exceedingly warm day? Among the methods used to prevent and stop fermentation, ice and cold occupy a front rank; but neither of these is always at everybody's command.

With Salicylic Acid, it is easy to accomplish the purpose by two different methods: either by dipping the substances to be preserved into a solution of Salicylic Acid (three grammes to a litre of warm water); or better still, preparing a preserving salt by an intimate mixture of cooking salt pounded fine, in the proportion of fifty grammes to one gramme of salicylic acid. In order to preserve meat for eight or ten days, in summer, carefully rub all its surface with this mixture. At the moment of cooking wash the meat in a little fresh water. The salicylic acid will leave no taste or smell.

In a pavilion of the fish hall in London, there is a reservoir filled with a strong solution of salicylic acid, in which the merchants, for a small recompense, dip their fish to keep them perfectly fresh for a long time. Moreover, this practice has the great advantage of purifying the surrounding air. The antiseptic properties of salicylic acid have been happily utilized by the owners of cod-fish ships; its regular employment has saved whole cargoes of cod-fish from the decomposition which menace them during the warm weather. We shall also say a few words about the use of salicylic acid for maintaining, in a good state for consumption, the canned substances of all natures, after they have been opened.

CARE OF TREES AND SHRUBS.

In view of the drouth which prevailes in many parts of the country and its unusual severity over large districts, the *Rural New Yorker* suggests to those who have planted trees or shrubs the past spring that there is one method, and so far as we know, says the writer, only one by which they may be protected against injury or death from that cause. Surface watering has been shown to do more harm than good. The ground is made hard and compact, thus becoming a better conductor of heat while it becomes less pervious to air and moisture. A portion of the surface soil should be removed, and then pailful after pailful of water thrown in until the ground, to a depth of two feet and to a width about the stem of not less than three feet in diameter, has become saturated. Then as soon as the water has disappeared from the surface, the removed soil should be well pulverized and returned. A covering of boards, straw, or hay, or even of sand or gravel, may then be applied, and the tree or shrub, thus treated, will pass through ten days of additional drouth in safety.—*Scientific American.*

EDITORIAL NOTES.

In our next number we shall have an article from the pen of Mr. C. A. Shaw, U. S. Signal Observer, at Madison, Wisconsin, on a Variable Scale for Barometric Pressures, presenting some original ideas based upon his experience as an observer.

Professor Oren Root, Jr., formerly Professor in the Missouri State University, recently Superintendent of the Public Schools at Carrollton, Mo., and now supplying the place of Rev. Dr. Kimball, at the Second Presbyterian Church in this city, has lately been appointed Professor of Mathematics at Hamilton College, New York. This is a very fitting appointment, though it is rare for an Eastern College to seek any portion of its Faculty in the West.

July was an unusually pleasant month, there having been but three days when the heat at 2 P. M. exceeded 90° in the shade, while there were none when the heat at 10 P. M. exceeded 81°, and very few where it exceeded 75°. The highest point reached by the mercury at 7 A. M., was on the 9th, when it marked 78°. The highest point reached in the middle of the day, was on the 13th, 96°, and the highest at 10 P. M. was on the same day, 81°, with pleasant breezes nearly every night. It showed the lowest average heat since July, 1876, when there was not a day whose maximum heat exceeded 90°, and only two above 88°.

Dr. John Fee, of this city, will hereafter regularly contribute to the REVIEW translations of popular articles from its German, French and Italian exchanges. This will be a decided advantage to our readers, not only from the freshness of the foreign matter thus furnished, but also from Dr. Fee's well known skill as a translator and transcriber of these languages.

Since our last issue we have made arrangements with Dr. E. A. Frimont of Ozuluama, Mexico, to correspond regularly with the REVIEW upon archæological, anthropological and other similar subjects. From what we know of him we anticipate very valuable and entertaining letters.

UNIVERSITY OF KANSAS,
LAWRENCE, KANSAS, July 26, 1880.

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"ALLOW me to congratulate you upon the success of the REVIEW, both popularly and scientifically considered. It fills a gap in our scientific literature and is an essential to every lover of science in our new America.

"Very truly yours,

F. H. SNOW."

THE 29th meeting of the American Association for the Advancement of Science, will commence on Wednesday, August 25th, at the Massachusets Institute of Technology, in Boston, and the general sessions will be held in Huntington Hall. Lewis H. Morgan of Rochester, New York, is President. Prof. F. W. Putnam of Salem, Mass., is permanent Secretary. A very large attendance is expected and the meeting will undoubtedly be of the greatest interest.

THE office of the *Caterer* has been removed to 141 Queen Victoria St., London, C. E.

RECENTLY a well equipped expedition has been dispatched to Central America, charged with the work of systematically searching for everything that may tend to place within the domain of history the facts connected with a people whose career must have been one of the most interesting in the general development of the world's civilization. The founders of these cities were our precessors on this continent; their peculiar civilization and their æsthetic development are of the highest interest as regards the question of the origin of man himself; their history is, in fact, the first chapter of the general history of the American continent. Though we are not the lineal descendants of these builders of the cities that must have rivaled even Babylon and Nineveh in some of their architectural features, the results of their culture have been left to our safe keeping, and from these results it is evidently our duty, as far as possible, to gather the materials for filling up the unwritten first chapter of our history. A full account of the explorations of the party comprising the expedition is to be published from month to month in the *North American Review*, with illustrations of the most important objects discovered. The August number of the *Review* contains an article by the editor introductory to the series, entitled "Ruined Cities of Central America." Other articles in the same number of the *Review* are "The Law of Newspaper Libel," by John Proffatt; "The Census Laws," by Charles F. Johnson; "Nullity of the Emancipation Edict," by Richard H. Dana; "Principles of Taxation," by Prof. Simon Newcomb; "Prince Bismarck as a Friend of America and as a Statesman," by Moritz Busch; and "Recent Literature," by Charles T. Congdon.

MR. HENRY SHAW, whose name has been rendered illustrious in connection with the botanical horticultural history of St. Louis, by the establishment of the new world-famous Botanical Garden bearing his name, and of Tower Grove Park, which he so munificently donated to the city of St. Louis, celebrated on July 24th, the eightieth anniversary of his birthday.

Professor F. E. Nipher, of the Washington University, St. Louis, Mo., who has been spending part of his vacation in verifying his magnetic observations, writes: "Our results are wholly in accord with the work of the two years before, and show that the conducting power of the soil, is what determines the *larger* abnormal deviations of the magnetic needle. Before I leave it I mean to settle the matter so that it will be evident enough. We start this evening for another tour from Salem southward to the Arkansas line"

THE sixty first volume of *Harper's Magazine* began with the June Number. In the July Number was begun a new serial novel by HENRY JAMES, JR., entitled "Washington Suqare"—an American story of unusual interest. The September Number will contain the continuation of WILLIAM BLACK'S "White Wings;" the third part of "Washington Square," by HENRY JAMES, JR.; "The American Graces," a biographical sketch of the three Misses Caton of Baltimore—Elizabeth, Mary and Louisa, who married respectively Baron Stafford, the Marquis of Wellesley, and the Duke of Leeds—with beautiful portraits of each; the second part of W. H. BISHOP'S "Men and Fish in the Maine Islands," illustrated by BURNS; "The Family of George III.," with twenty-one portraits—fac-similes of old engravings from paintings by the best English artists of the latter part of the eighteenth and the first quarter of the nineteenth centuries; the third part of REBECCA HARDING DAVIS' "By-Paths in the Mountains," illustrated by GRAHAM; "The Seven Sleepers' Paradise Beside the Loire," an illustrated paper by M. D. CONWAY; a beautiful poem by WILLIAM M. BRIGGS, entitled "Amid the Grasses," illustrated by WILLIAM HAMILTON GIBSON; "Squatter Life in New York," by WILLIAM H. RIDEING, with characteristic illustrations by SHULTZ and KELLEY; and the usual variety of short stories, timely articles, etc.

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THE *American Bookseller*, which is itself an almost indispensable aid to librarians and other book buyers, commenced the publication on July 1st, 1880, of the *Monthly Index* to current periodical literature, proceedings of learned societies and government publications. It consists of the titles of the best articles in all the leading periodicals of the United States, whether scientific, professional or literary, and is well worth its price to the student in almost any branch of education who can not afford or has not the time to read all the current literature of the day. $1 per annum. 10, Spruce St., New York.

The *Industrial World and National Economist*, Vol. 1, No 1, presents itself as an advocate and gazetteer of Home industries, Commerce, Finance, Insurance, Railroads and Mining. It is published weekly at Montreal. $3 per annum.

The *American Naturalist* for August, says that Mr. J. Walter Fewkes, of Boston, has been engaged to deliver a course of lectures on natural history to the public schools of Newton, Mass., and handsomely endorses both the scheme and the teacher engaged.

A critic in the *Atlantic Monthly* speaks of Mr S. S. Cox's Search for Winter Sun Beams as "depressing reading, from the fact that that the author seems to have labored continually under the feeling that it was incumbent upon him to be funny, and in obedience to this sense of duty he frequently indulges in jests by the side of which grinning through a horse collar is a serious and dignified occupation."

Science is a new illustrated weekly record of Scientific Progress, edited by John Michels, and published at 229 Broadway, New York. It is intended to be a medium for presenting immediate information of scientific events, and each department is to be under the supervision of a specialist in that department. The first number made its appearance July 3d, in quarto form, 12 pages, 10 cents per number.

WE have received Nos. 126 and 127 of *Le Technologiste*, Louis Lockert, Rue Oberkampf, Paris. This is a weekly publication devoted to the application of science to the industrial arts. Its eminently useful and practical character can be readily understood from a summary of contents: Bleaching of Cotton in Skeins; On the Method of Stamping Gold and Silver Colors on Woven Goods; On Decorative Weaving; The Preservation of Foods by Salicylic Acid; The Adulteration of Tobacco; Defibrating of Sugar Cane; On Rag Sugar; A New Compound Cement for Pavements; The Coloring and Decorating of Porcelain and Chinaware. We cheerfully commend this journal to the manufacturers of the United States.

"L'EXPLORATION." Revue Des Conquêtes de la Civilization Sur Tours les Points du Globe: M. Paul Tournafond, 35 Rue De-Grenelle, Paris. This handsome weekly of sixty pages, large octavo, is now before us. It is devoted to the collection and diffusion of geographical knowledge. Its editor assures us that it is the single tie that binds together the only sixty-five geographical societies that are scattered over the five great divisions of the globe. In the present number we observe a lengthy extract from Hall's second Arctic voyage, by James Jackson, a long and original letter from Soudan from the pen of Dr. Matteucci, who is now directing the Italian Scientific expedition to Central Africa. Shorter articles from various parts of the Globe, civilized and uncivilized, some necrological announcements and a new map of Cochin China complete the issue. We are happy to say that no one, who intends to be abreast of the latest geographical researches, can afford to be without *L'Exploration*.

MR. ALDRICH'S "Stillwater Tragedy" in the *August Atlantic* grows in interest. Dr. Holmes in a characteristic poem, entitled "The Archbishop and Gil Blas," sings with a pathetic felicitousness of growing old. John Burroughs, one of the most charming of outdoor writers, contributes "Pepacton: A Sum-

mer Voyage down the Delaware." Mark Twain has a very pungent tale entitled "Edward Mills and George Benton," which satirizes keenly certain forms of pseudo-philanthropy. Mrs. Wallace, wife of General Lew. Wallace, Governor of New Mexico, writes "Among the Pueblos;" Richard Grant White's English article this time is "Taurus Centaurus." The political article discusses "The Republicans and their Candidate" whom it regards as wholly worthy of confidence and enthusiastic support. Col. Higginson and Susan Coolidge furnish poems; and reviews of new books and an attractive variety in the "Contributors' Club" complete a capital Summer number. The *Atlantic* for September will contain two important political papers: one on Candidates and Parties, and the other relating to the duties of independent voters at the present juncture; also, a brilliant society story by the author of "One too Many"; a study of the intimate life of a noble German family; a study of the people of a New England factory village; an article on women in social and charitable organizations; a paper on socialistic assassinations; and a full variety of essays, reviews and poems.

From the Catalogue of students at the University of Kansas for this year, we glean the following items: The number of students is 438—being an increase over last year of 38. Missouri sends seventeen, of whom six are from this city, viz.: Miss Ethel B. Allen, R. W. E. Twitchell, Wm. G. Raymond, Orais E. Smith, A. M. Finney and H. M. Lewers. Eighteen different states are represented. The prospects are good for 500 students next session.

PROF. E. T. NELSON of the Ohio Wesleyan University, in writing for back numbers of the first and second volumes of the REVIEW, takes occasion to speak thus most flatteringly of it: "I feel it to be the *best* journal for the general student that is published in our country. It is for this reason that I wish to complete my set."

THE *Popular Science Monthly* for July and August, reached us about the same time, the former too late for serviceable notice. The contents of the latter are varied and valuable, comprising articles on The Kearney Agitation in California, by Henry George, in which an attempt is made to show that "law" governs human actions as it does the conditions of the material universe, and that social phenomena may be attributed to general rather than special causes; the second chapter of Radeau's Interior of the Earth, translated from the *Revue des Deux Mondes:* The Method of Zadig, by Prof. T. H. Huxley, which is a very attractive account of the manner of scientists in the interpretation of fossil remains and the method of reasoning which enables them from a fragment of an extinct animal to prophesy, not only the character of the whole organism, but its past and future conditions; The Medicinal Leech; Recent Original Work at Harvard College; Geology and History; The Cinchona Forests of South America, and many others equally valuable. As usual, the Editor's Table and Literary Notes constitute a very attractive feature.

OUR space is too limited to say more of *Good Company* for August, than that it continues to maintain a literary character which fully justifies it in assuming so self appreciative a title. It is a society magazine of just the kind to suit the best families all over the land.

THE *American Antiquarian* for April, May and June, being No. 4, of Volume II, is decidedly the best number yet issued, and deserves an extensive sale. In our opinion, no magazine of its class, either in the United States or across the water, equals it. Rev. Stephen D. Peet, is editor, but he has as associates, Prof. E. A. Barber of Philadelphia, Prof. R. B. Anderson, Madison, Wis., A. S. Gatschet, Washington, D. C., and Rev. Selah Merrill, Andover, Mass.; while he has as contributors apparently nearly all of the archæologists of the country.

XUM

SPECIAL NOTICE.

It seems to have become altogether a fixed thing for T. M. James & Sons, to put their latest importations of rich China and Queensware goods and artistic novelties on exhibition at the opening of each week and upon arrival of new invoices, and the frequency of such receipts affords our citizens many opportunities to examine choice handiwork from abroad and emanating from the most celebrated patterns and embellished by the hands of eminent artists. To-day may be seen in the show windows of T. M. James & Sons a late importation of admirable qualities, and splendid display of hand painted vases of Ionic and Grecian shapes and decorated in the most pleasing manner in landscapes, sporting scenes and classic groups. These goods are very seasonable and their price is very low, considering their elegance, and will repay a close inspection and ought to find a place in a great number of households in our city and suburbs. Messrs. James & Sons are still in almost daily receipt of rich Chinaware elegant Glassware and a great variety of other goods requisite in their large trade. A visit to this great importing house is time profitably spent both in pleasure and economy of prices.

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